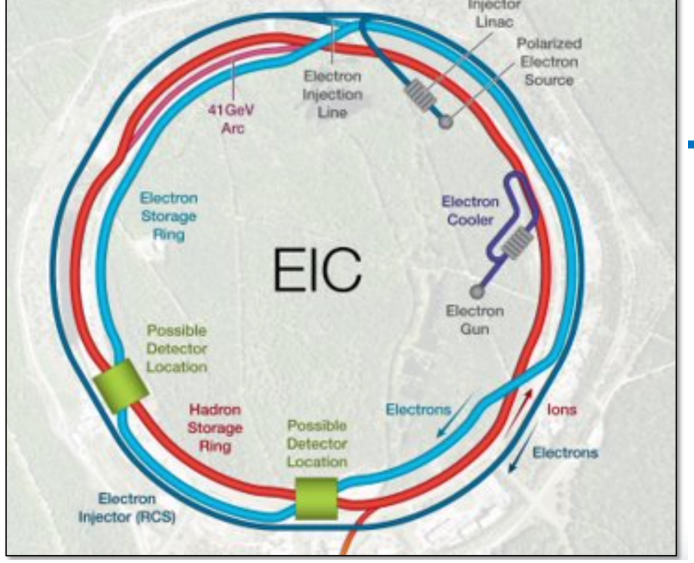


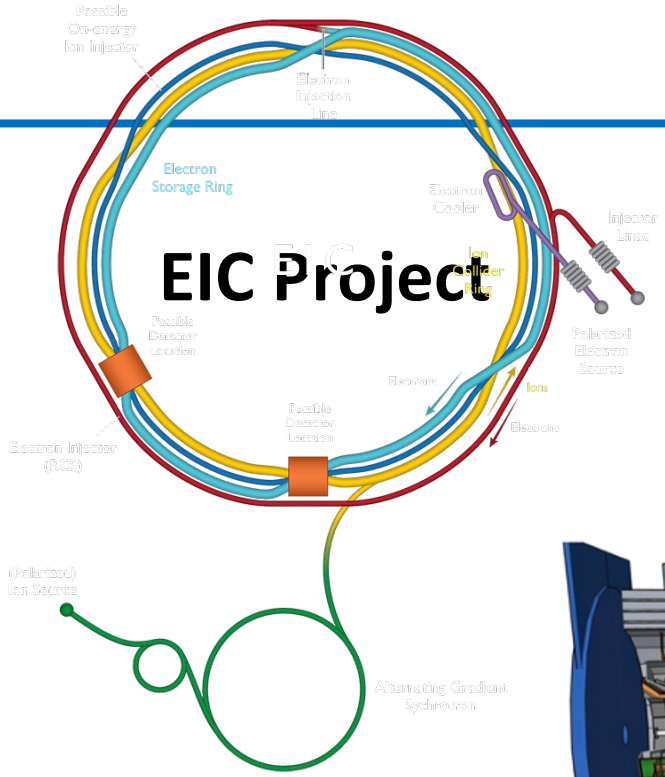
EIC_NET status: post-Summer

P. Antonioli

INFN-Bologna

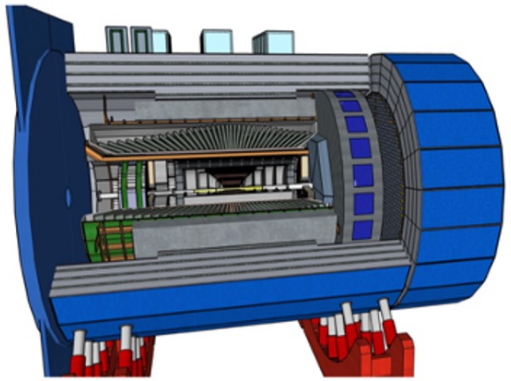
EIC_NET 2021/2022 Annual Report available at: https://cernbox.cern.ch/index.php/s/fhcWqVKbYCg6Am7

CSN3 – EIC_NET: settembre 2022: https://agenda.infn.it/event/32062/contributions/176243/attachments/96768/133401/CSN3-20220920-PA-EIC_NET.pdf

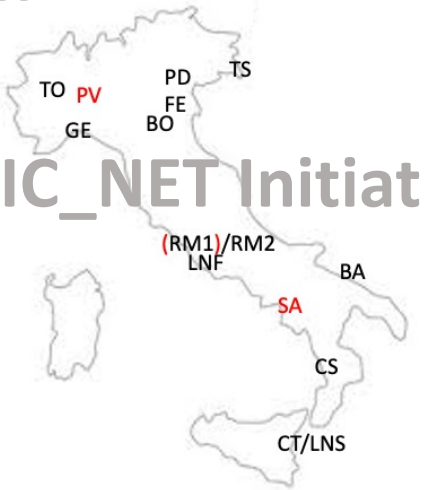


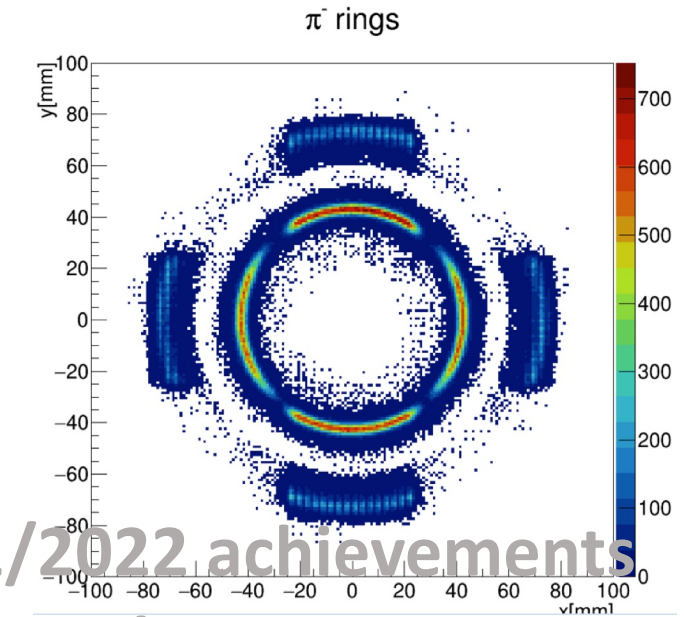
EIC Project

EPIC Collaboration



EIC_NET Initiative





2021/2022 achievements & 2024 plan

Last meeting (Giornata Nazionale Catania 30/6-1/7
https://agenda.infn.it/event/30932/

Status EIC project: a little bit of US politics

Tortuous legislation path delayed/curbed funding for EIC for FY22 but FY23 and next years look much better

1

The New York Times

10 August 2021

Senate Passes $1 Trillion Infrastructure Bill, Handing Biden a Bipartisan Win

The approval came after months of negotiations and despite deficit concerns, reflecting an appetite in both parties for the long-awaited spending package.

(it was originally proposed at $2 Trillion)

2

Budget approval for FY22 (Sep21/Aug22) delayed until March 2022!

10 March 2022

CONGRESS

Senate passes 2022 federal spending bill, sends to Biden's desk

Jared Serbu | @jserbuWFED
March 10, 2022 10:18 pm 4 min read

The Senate voted 68-31 Thursday night to pass a $1.5 trillion omnibus bill that will fund federal government agencies for the remainder of Fiscal Year 2022, following in the footsteps of the House, which passed the measure the previous evening. The bill now goes to President Biden's desk.

3

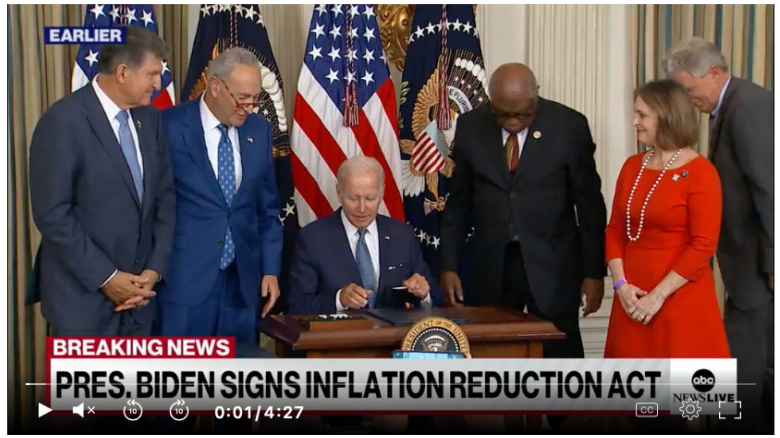
17 August 2022

Calculate how much Biden's Inflation Reduction Act may save you

The $739B measure will immediately impact people's wallets.

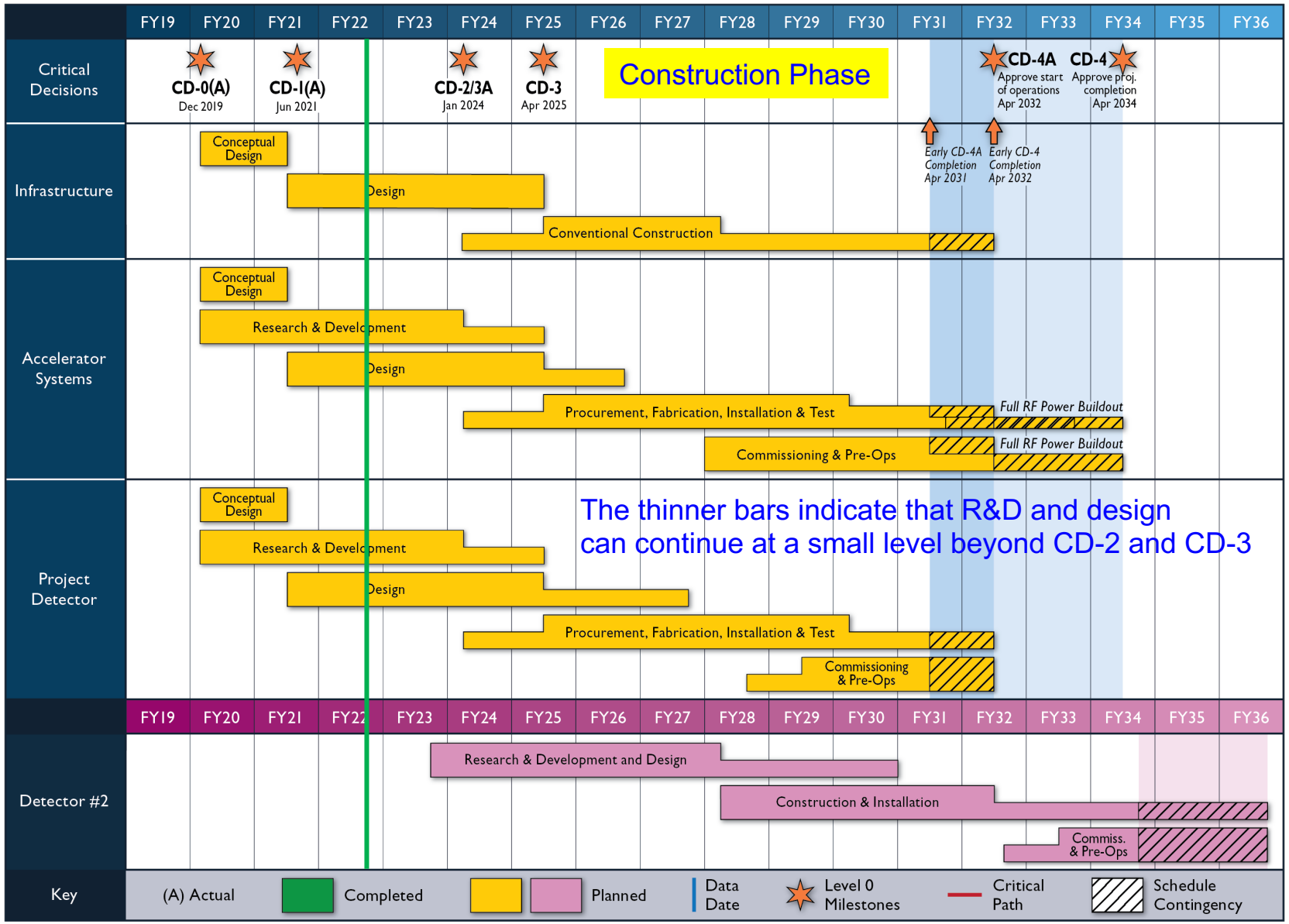
By Max Zahn
August 17, 2022, 4:26 PM

Share



Biden signs historic climate, tax bill into law
President Joe Biden on Tuesday signed the Inflation Reduction Act into law, which enacts sweeping changes to the country's climate and healthcare policies.

Status EIC project: timeline



CD-2/3A moved to Jan 2024
October 2023 pre-TDR

CD-3 moved to April 2025
TDR end of 2024/Jan 2025

As detector we need to be ready by Jun 2031

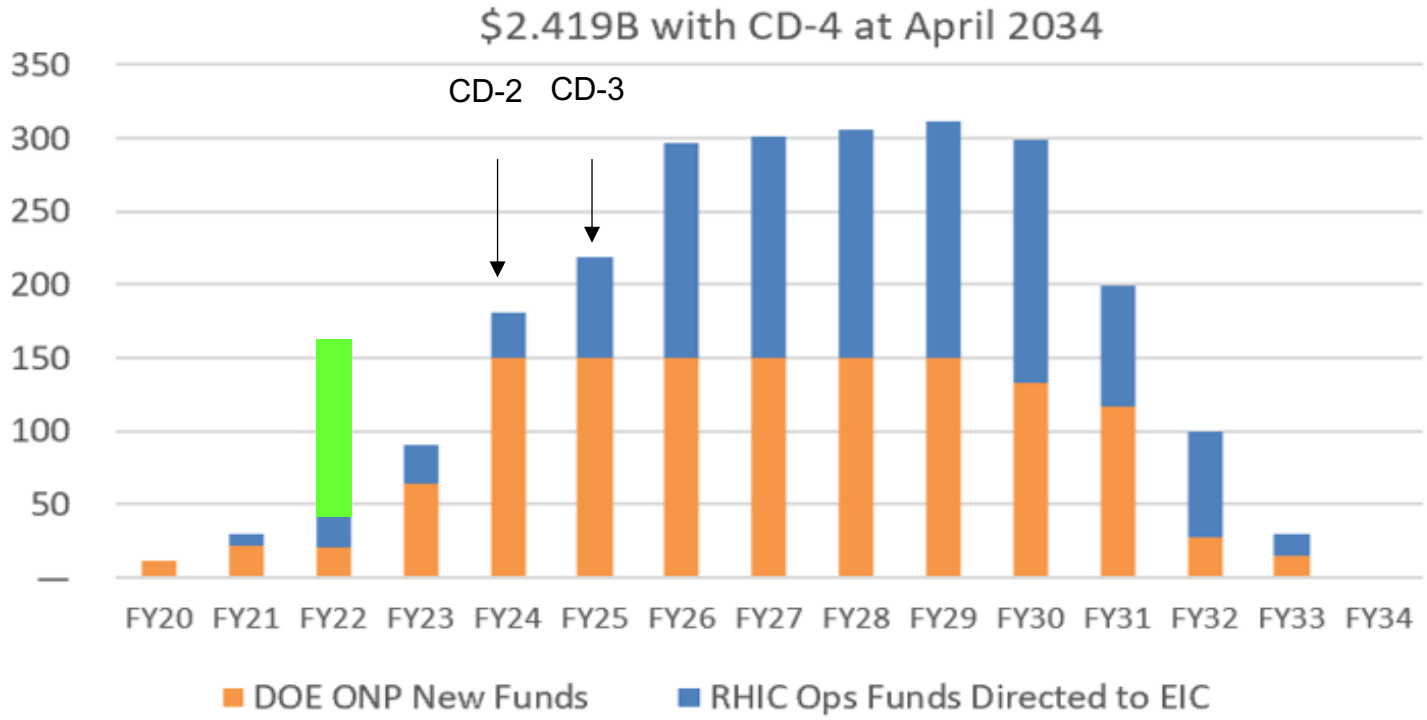
(Italian community focused on “detector 1”)

Status EIC project: funding

From R. Ent/E. Aschenauer 11/09/2022

Inflation Reduction Act:
$217M to Nuclear Physics in FY22 to be spent by FY27.

- EIC (to get to CD-2) – may end up in the $110M-$138M range
- (also funds to complete MOLLER@JLab, HRS@FRIB, GRETA@FRIB, and for 0nubb (to get to CD-1))



IRA funds can ONLY be used for project scope, but NOT to add scope

Because they can be spent up to FY27 they (or some of them) can provide a buffer against "esercizio provvisorio – continuing resolutions"

With all needed caveat,
project passed non-returning point most likely

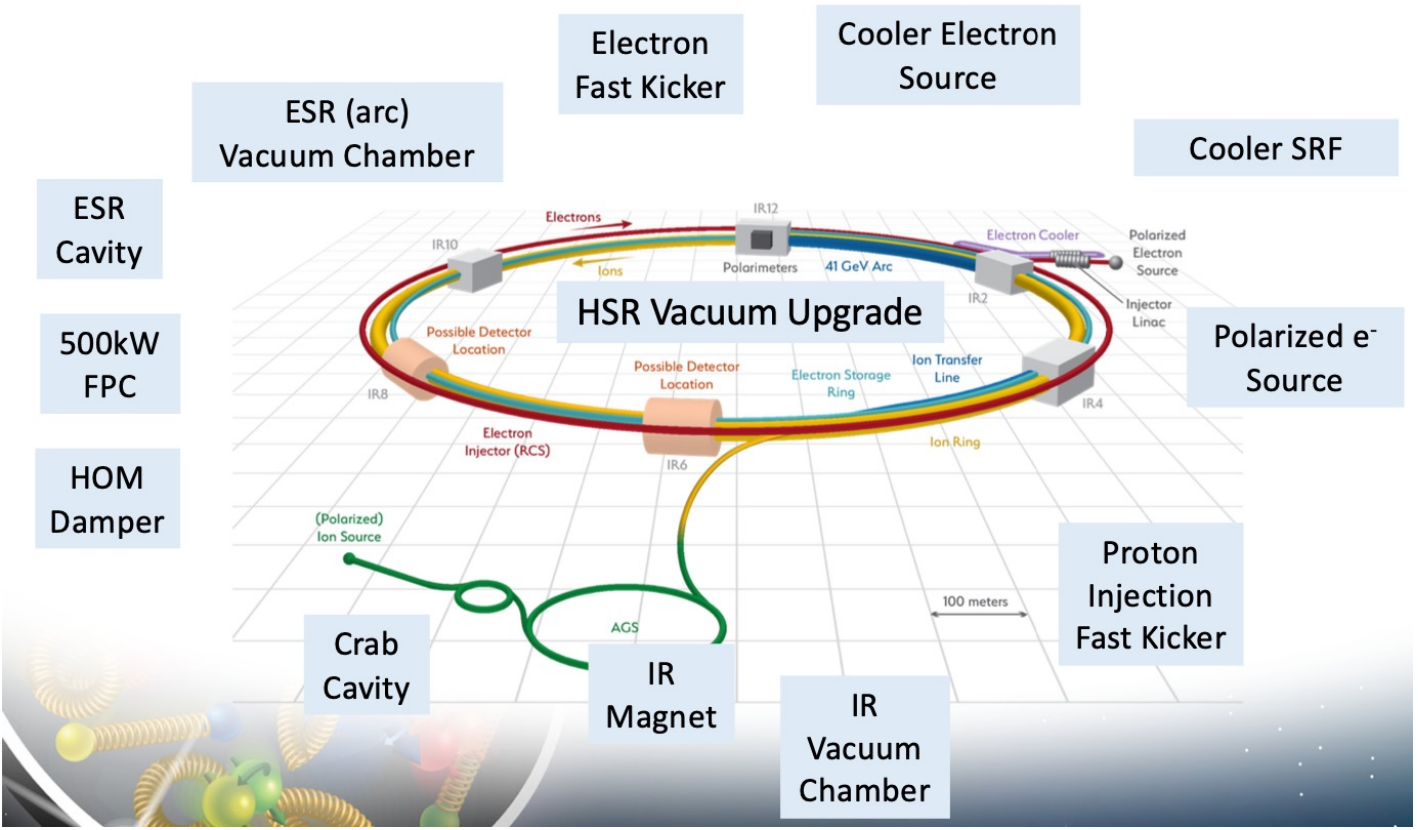
Status EIC project: the accelerator

Many developments in critical R&D for accelerator design

T. Satogata@EICUG meeting – July2022

https://indico.bnl.gov/event/15342/contributions/64650/attachments/42380/70993/2022-07-26-EICUG-Satogata-AcceleratorDesign.pdf

EIC Accelerator R&D Scope



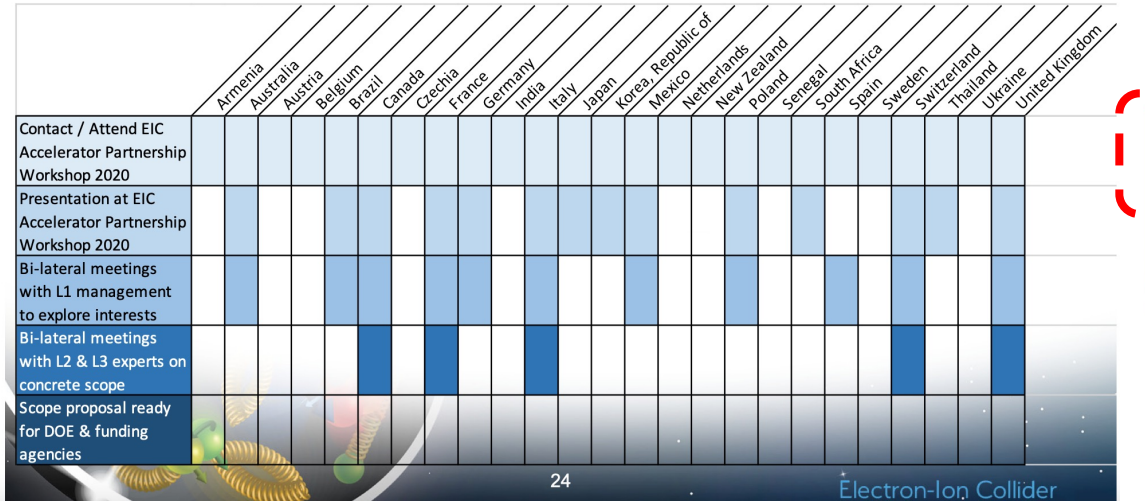
- design consolidation of different components needed
- no show stoppers
- R&D needed in different areas but not critical
- HSR Vacuum upgrade needed due to higher current and shorter buch length:
  - resistive-wall impedance
  - e-cloud buildup

  Solution identify in copper-clad (to reduce resistivity) and aC (amorphous Carbon) thin film to reduce secondary electron yield

EIC accelerator: international contributions (& INFN)

International Engagement - Accelerator

- Active engagement ramped up last summer through meetings with DOE and funding agency reps, Accelerator Workshops, and dialogue with potential partners
- Collaborations contributing to both design and hardware that cover a broad range of WBS items are in development
- Bi-lateral meetings now expand from EIC L1 management to L2 & L3 EIC experts for detailed technical discussion of possible in-kind scope
  - Examples: **Crab Cavity** system information exchange meeting w/UK and Canada, meetings w/INFN-Accelerator collaboration on **HSR vac. system**, w/CERN on **ESR vac. sys**., etc.



INFN acceleratori involvement?

See A. Gallo @ INFN Acceleratori workshop (Milan April 2022)
https://agenda.infn.it/event/29704/timetable/#20220407

T. Satogata@EICUG meeting

Potential Accelerator Contributions

- Italy, INFN
  - HSR vacuum chamber inserts
- Canada, TRIUMF
  - SC Crab Cavity system
  - Pulsed systems
- UK, ASTEC & Cockcroft Inst.
  - ERL components
- France, IJCLab
  - SHC ERL diagnostics
- France, CEA Saclay
  - IR SC magnets
  - SC spin rotators
- CERN, Switzerland
  - ESR SC cryomodules joint design
  - ESR high current elements joint design
- Japan, KEK
  - ESR collimation system

High level readiness of technical status
Possibly, first case for use of seed funds

High level readiness of technical status

Project is developing possibility of "Seed" funds for EIC international collaboration that can enable early start of EIC accelerator design efforts in partner countries

- Recent & tentative:
- Israel, SARAF
  - RF power amplifiers, collimators, controls
- Sweden, Uppsala Uni.
  - SSPA

EIC and high-level governance

Shown by R. Ent & E. Aschenauer, 9th June Det-1 Gen. Meeting

Recent and near future Project Meetings

- Meetings with BNL & JLab lab directors, DOE/NP and a few international funding agency partners to further EIC Governance
  - EIC Advisory Board Meeting (formerly the EIC Council)
    - Provides advise on the construction of the facility
    - Membership: Senior leaders of institutions making significant contributions to the facility including national labs
  - Contrasted by Resource Review Board (RRB)
    - Provide coordination among funding partners and oversight of the experiment
    - Membership: One representative from each funding agency that sponsors the project detector and/or computing resources
    - First “RRB-like” kick-off meeting in early autumn – will likely require some detector-1 leadership involvement also

→ Next step is further develop draft plan for these and collect input from EICUG and other stake holders

- Preparations for FPD Status Meeting in full swing
  - will discuss the nice progress since the DPAP report
  - cost and schedule update and status of in-kind

2 Electron-Ion Collider

DoE meeting with "main" funding agencies about EIC governance
8 April (D. Bettoni for INFN)

16 June INFN in-camera meeting with DoE (Washington)

→ next months we will need to see how it is practically shaped this "dual" bodies governance and actual role ("CERN-like but...")

First kick-off RRB meeting: 12-13 October

Status EIC project: eRD "targeted" funding + FY23

Project	Topic
eRD101	Modular RICH / aerogel RICH
eRD102	Dual-radiator RICH
eRD103	High-performance DIRC
eRD104	Silicon service reduction
eRD105	SciGlass
eRD106	Forward EMCAL
eRD107	Forward HCAL
eRD108	Cylindrical / planar MPGD
eRD109	ASICs / electronics
eRD110	Photosensors
eRD111	Silicon tracked (excluding electronics)
eRD112	AC-LGAD (including ASIC)
eRD113	Sensors for silicon trackers

BA-BO-CS-CT-FE-LNF-LNS-RM1-SA-TO-TS

GE-RM2 (streaming readout)

TO

BO-FE-CS (**SiPM**) + TS-GE (**LAPPD**) (TO in FY22)

BA-TS-PD

BA-TS-PD

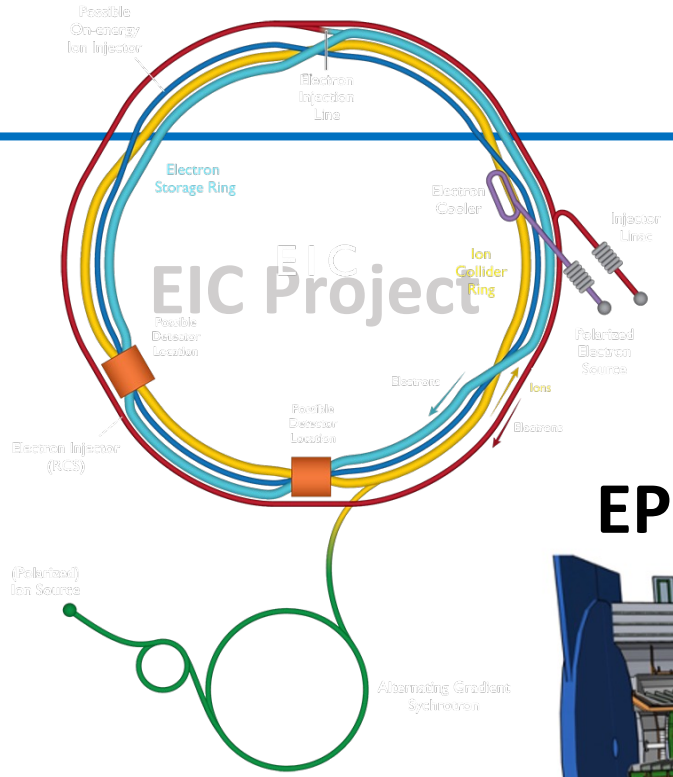
Focus on detector R&D common to protocollaboration proposals

Resources finally allocated by EIC project in April 2022 for FY22 (7 months delay due to US delayed approval of Federal Budget): 265 k$

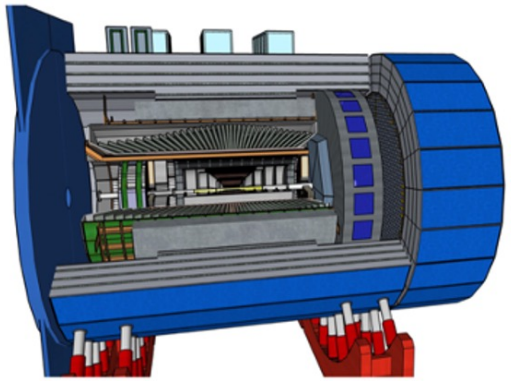
- Resources mainly for post-doc and/or PhD positions
- eRD projects as a space to build alliances/consortia for detectors

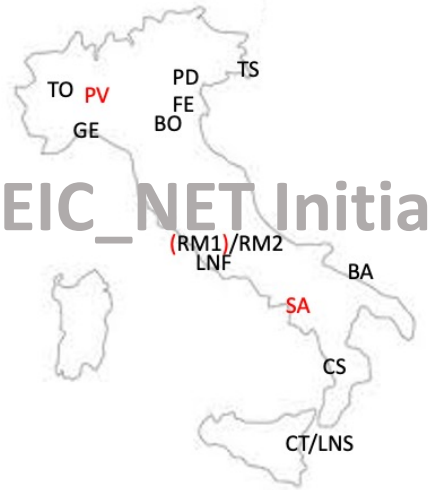
16387 Approvazione della partecipazione ai progetti "eRD105 SciGlass R&D", "eRD102 dRICH" e "eRD110 Photosensors" finanziati nell'ambito della call FY2022 dell'EIC Project Detector R&D Program

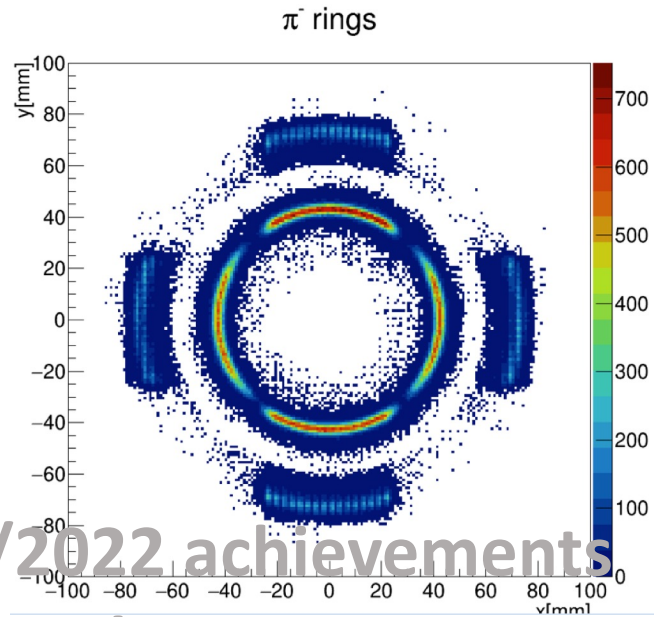
- Agreed unique SoW for INFN → "sigla" EIC_RD as "external funds"
- Negotiated INFN Statement of Work for the three projects where we got funding → **del. CD 16387 -22/7/2022**
- **Call FY23 by 1st October:** filled by various EIC_NET groups!



EPIC Collaboration





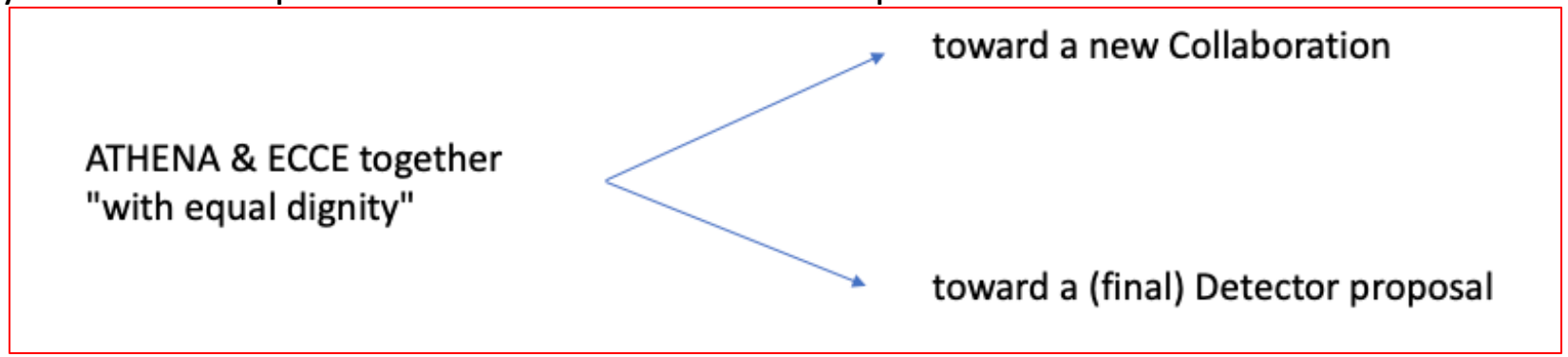


Status of EIC project: 2022 a year of "coalescence"

Jan/Feb: waiting for DPAP report
8 **March** DPAP report presented orally in a open session https://www.bnl.gov/dpapanelmeeting/
→ **both ATHENA and ECCE recognized as solid proposals, satisfying YR requirements**
→ **ECCE selected as reference design**
→ many follow-up meetings and Steering Committee formed by previous leadership of ATHENA/ECCE
→ decision to move on toward a one detector/Collaboration joining efforts
→ wide consultation also within EIC_NET community

29 April: first meeting of new "Detector 1" Collaboration
May: creation of transitional Working Group
July: EICUG meeting (Stonybrook) → EPIC Collaboration is born [300 attendants, 100 in presence, important INFN attendance, noted!]
August: consolidation of magnet design/option
by October: adoption of EPIC Charter + leadership election

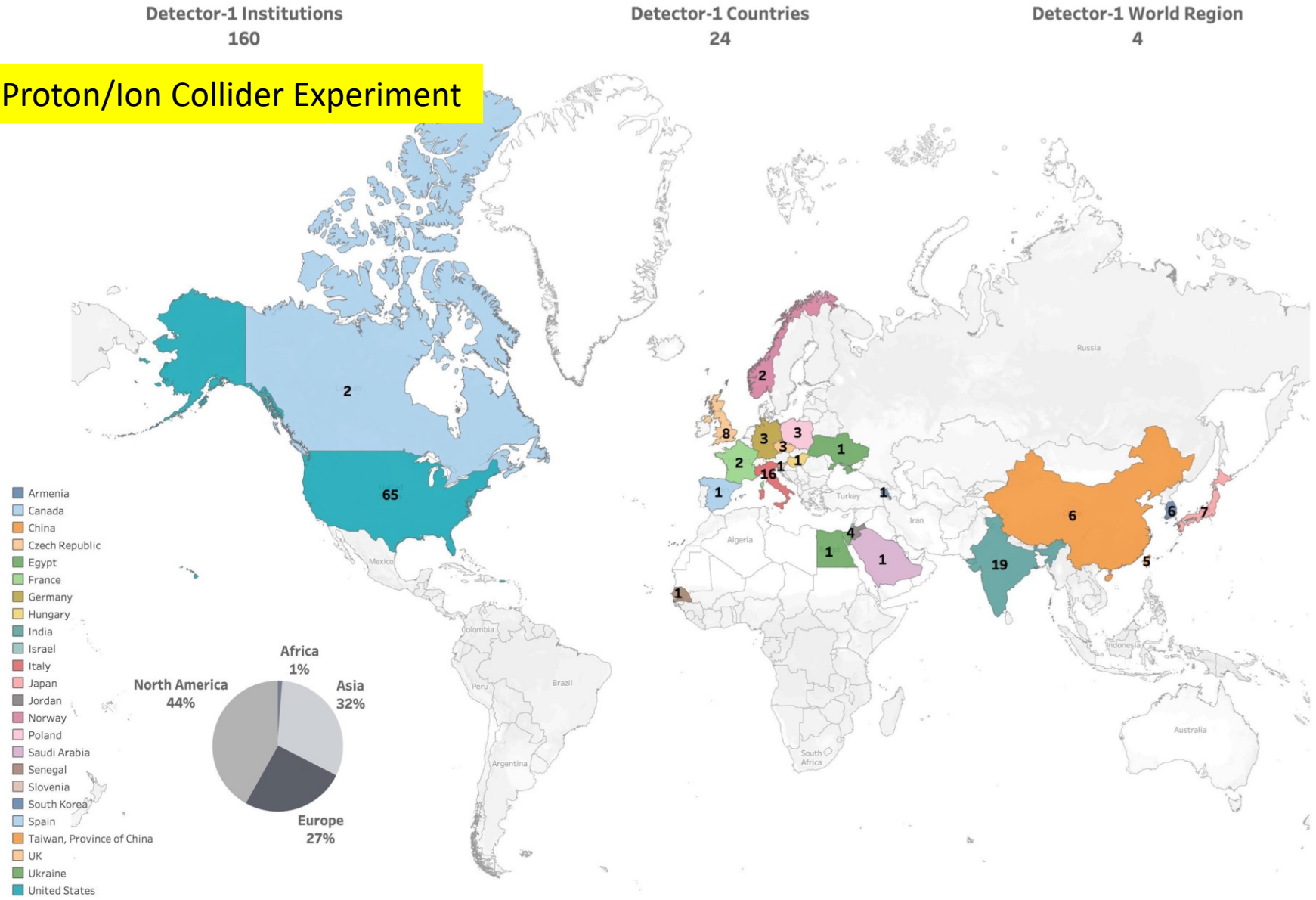
After Catania meeting



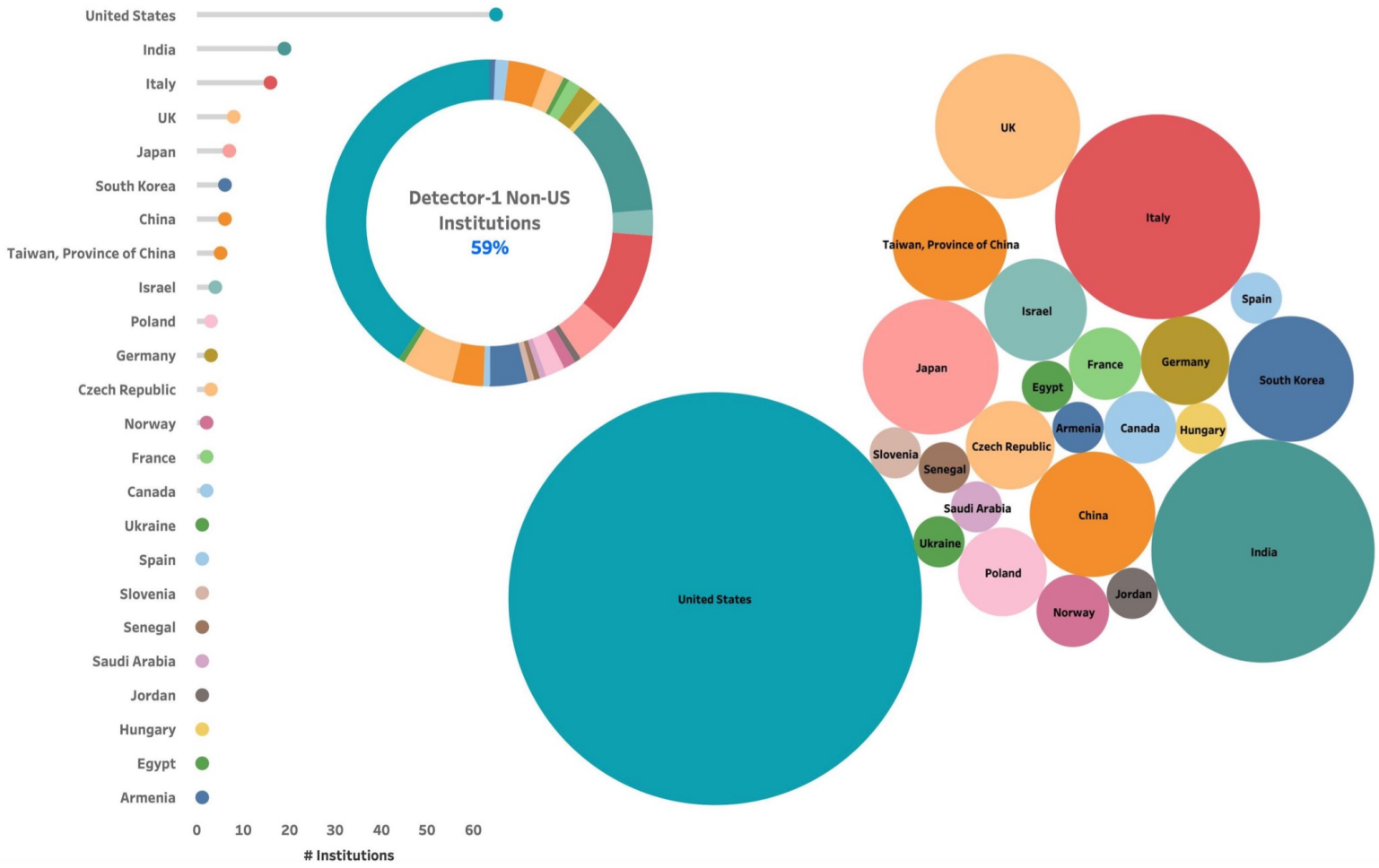
INFN contribution (dRICH / Si-Vertex) firmly established in detector design

EPIC: geography

ePIC: the electron Proton/Ion Collider Experiment



EPIC: demography

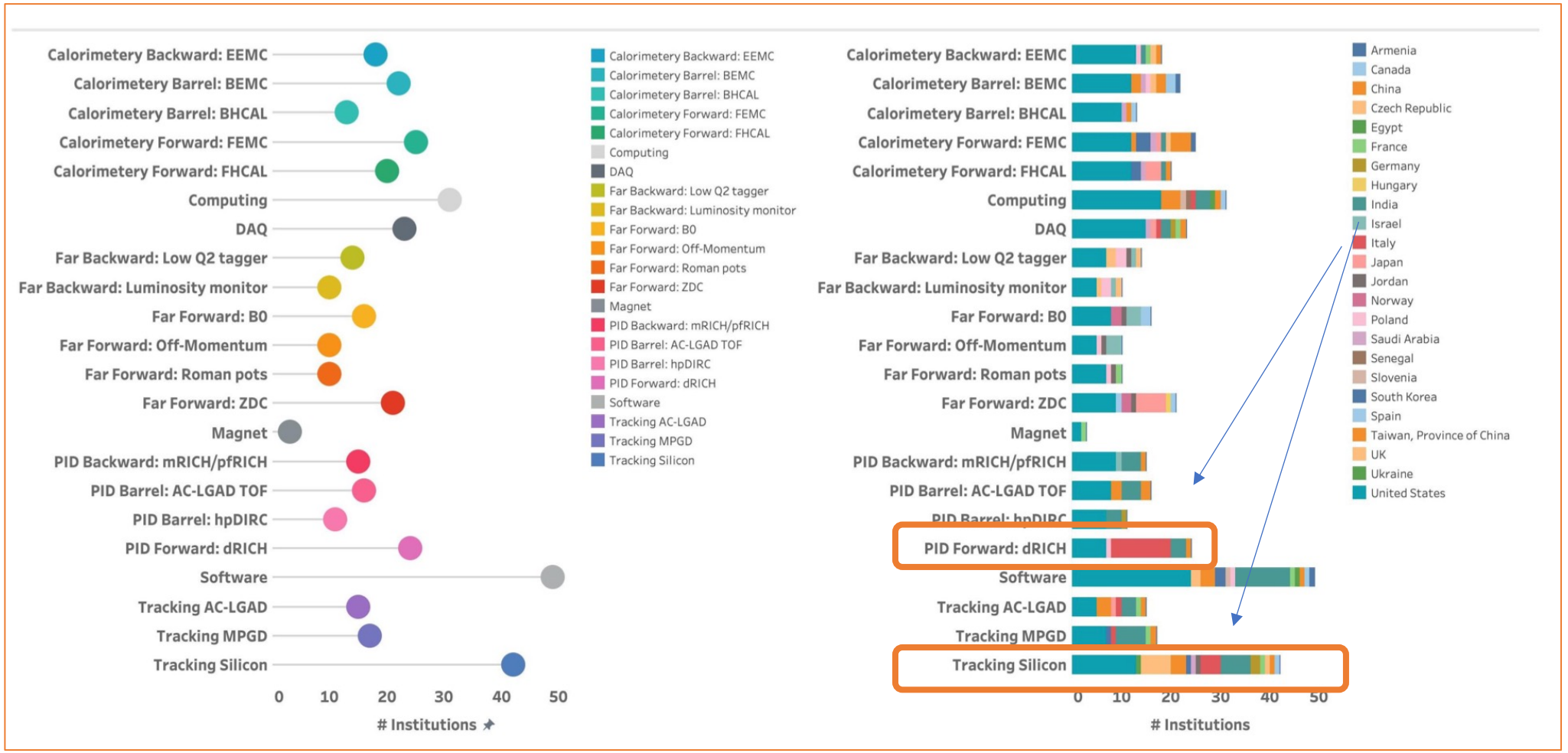


Italy is (after India) second largest non-US country parteicipating in terms of institutions

INFN in EPIC:

- 1/5 member of the interim Steering Committee: Silvia Dalla Torre TS
- 4/60 WG conveners (A. Bressan TS, S. Dalla Torre TS, R. Preghenella BO, M. Radici PV)
- 1/8 member of the Charter Committee (P. Antonioli BO)
- → all 15 RL of INFN units are members of the Colaboration boardl

EPIC: Sub-System interests



+ Computing/Software and DAQ

ePIC: on-going discussion towards pre-TDR

Hot items in consolidation/optimization

An introductory list (much more during the DETECTOR-1 meeting)

- ❑ Optimization of barrel tracking
  - ○ Achieve a realistic, low-mass design with good performance
  - ○ MPGD selection (μRWell / MM)
- ❑ Reference design did not include backward HCAL
  - ○ Is there a strong physics justification?
- ❑ The two barrel EMCal solution imply a different physics emphasis
- ❑ AC-LGADs are new, unproven technology
  - ○ Potential for risk-reduction
- ❑ PID in backward region (two competing technologies)

- ***This process must be driven by the physics performance based on a holistic approach***
- ***Integration aspects also to be considered***
- ***Iterative process toward optimization***

EICUG meeting, Stony Brook, 7/26-29 , 2022 S. Dalla Torre INFN 13

+ (from INFN-perspective):

"space" optimization for dRICH remains critical. ECCE community was clearly less dRICH oriented in design

TOF AC-LGAD layer seems more a complication can something helpful for dRICH (instead of a tracker behind dRICH)

potential synergies between dRICH and PID backward depend on the choice of technology

ePIC: the magnet, at the end

at EICUG meeting

- confirmed ECCE proposal tracking performance overevaluated due to lack of materail budget for support structures
- concerns about re-use of BABAR/sPHENIX magnet

→ towards new magnet (Jlab/CEA project) from backup solution to "plan-A"

in the meantime (**update at EPIC meeting 18/08**)

a) BaBar magnet re-use officially rated "high risk"
b) conductor choice (Al) for ATHENA design not feasible!
c) to make a robust (>1.5 T) magnet a solution is possible
increasing conductor layers (Cu) from 4 to 6
d) magnet might operate at 2T, certainly safe 1.5-1.7 T

😊 no big impact in geometry and material budget
😊 performance within YR requirements
🤨 + 5 M$ in costs (total 15 M$)

🙃 "ECCE was wrong, ATHENA not feasible, DPAP advised for the more risky option."

New Magnet Design – Nuclear Interaction Lengths

Thickness/Nuclear interaction length				
BaBAR	New	ATHENA/SOCRATE	Marco	2T magnet
0.344	0.000	0.650	0.000	0.000
0.011	0.167	0.170	0.115	0.173
0.000	0.239	0.417	0.239	0.239
0.007	0.014	0.020	0.003	0.004
0.362	0.420	1.258	0.356	0.415
	What we asked you earlier to bless	achievable only with Al-conductor	Where we ended after conductor choice	With 6 layers of conductor

thickness of magnet critical for barrel HCal performance
→ if too thick HCal becomes a MuID

Preparing for pre-TDR "Preliminary design"

Plans for Design Maturity

System	Estimated Design % Complete ---------- Now	Estimated Design % Complete ---------- CD-2 / 3A	Estimated Date for Final Design Complete	Comments
6.10.02 Detector R&D/Physics Design	0%	60%	06/30/2026	Project R&D just started
6.10.03 Tracking	10%	50%	12/31/2026	Need only late
6.10.04 PID	15%	50%	03/31/2026	hpDIRC well underway
6.10.05 EmCal	20%	85%	12/31/2024	eEMCAL far ahead
6.10.06 HCal	15%	70%	06/30/2025	Barrel Hcal reuse, rest delayed
6.10.07 Magnets	30%	100%	12/31/2023	LLP, completed 30% design
6.10.08 Electronics	10%	50%	03/31/2027	ASICs/electronics can come in late

What Does a Preliminary Design mean

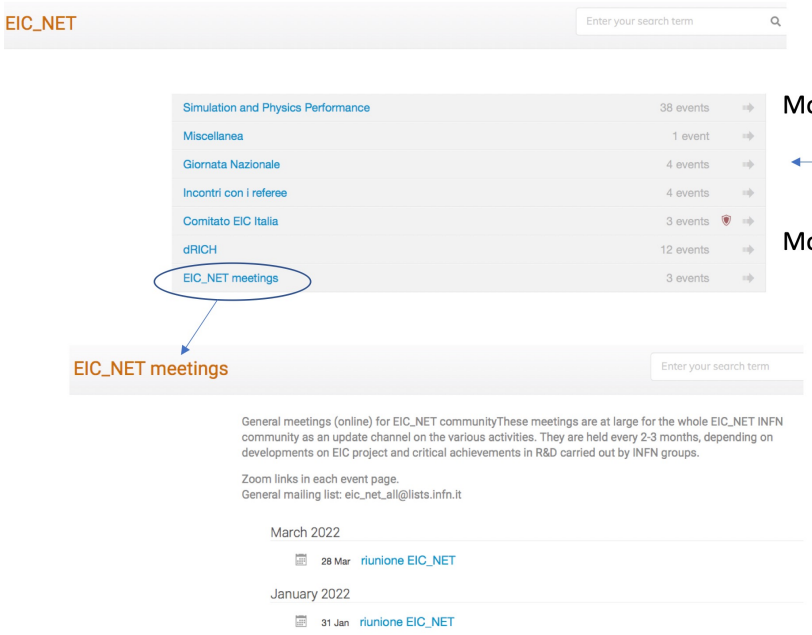
Example: dRICH

- need to define the sub-detector technology to a level of detail that we can baseline cost, schedule and workforce and functional requirements needs
- what do we build: a CF-gas + Aerogel RICH or is the CF-gas replaced with a pressurized or cooled Argon
  - vessel design needs to be well advanced
- geometry of the subsystem and how it is integrated in the overall detector
- photon-sensor technology and # of readout – channels
- what is the front-end electronics, what ASIC will be used
- define mirror - system
- what needs to be cooled and how
- 3d-CAD of the detector with details how the detector will be assembled, drawings of the different components but not on fabrication quality
- design of gas system
- slow control and monitoring of hardware systems are needed, how do we realize it
- A worked-out concept (but no detailed plan) of assembly and service needs

There can still be some open questions (but not affecting costs and schedule in major way), further engineering design to be done, detailed drawings to be done, etc.

How to get involved (EIC_NET)

https://agenda.infn.it/category/1147/



Monday at 11:30-13:00 bi-monthly

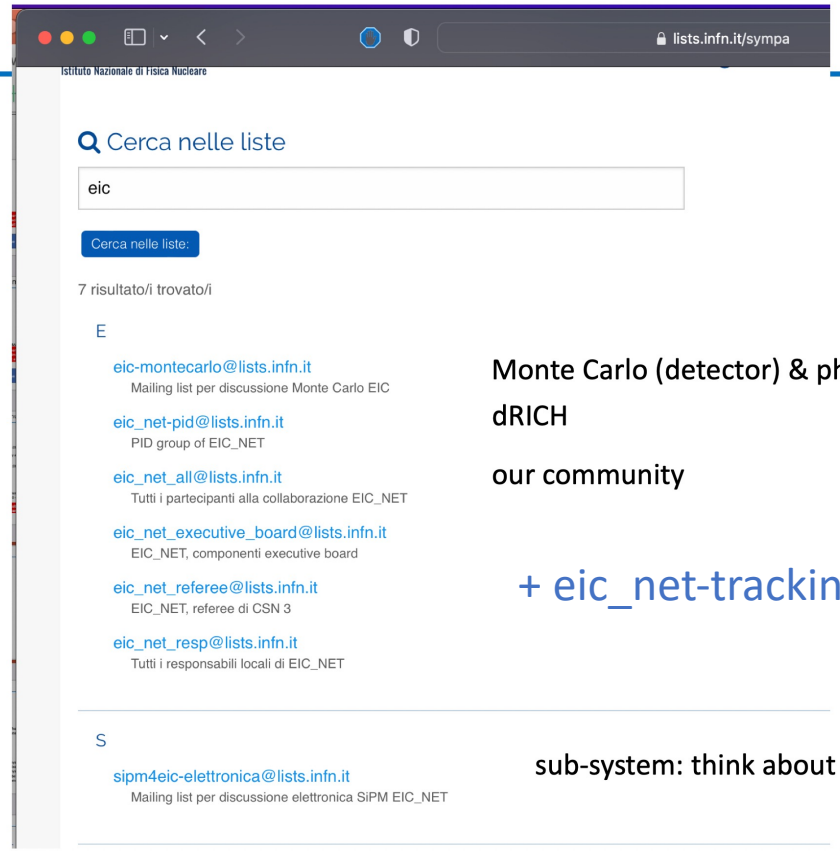
← today and previous editions (since 2019)

Monday at 11:30-13:00 bi-monthly

Quarterly general meetings (online)
Monday 10:00 – 13:00

next: October 3rd
December 5th

- Monday meeting for simulation likely to be moved to other day/time
- SiPM electronics is meeting on Tuesday at 9:00 AM



Monte Carlo (detector) & physics

dRICH

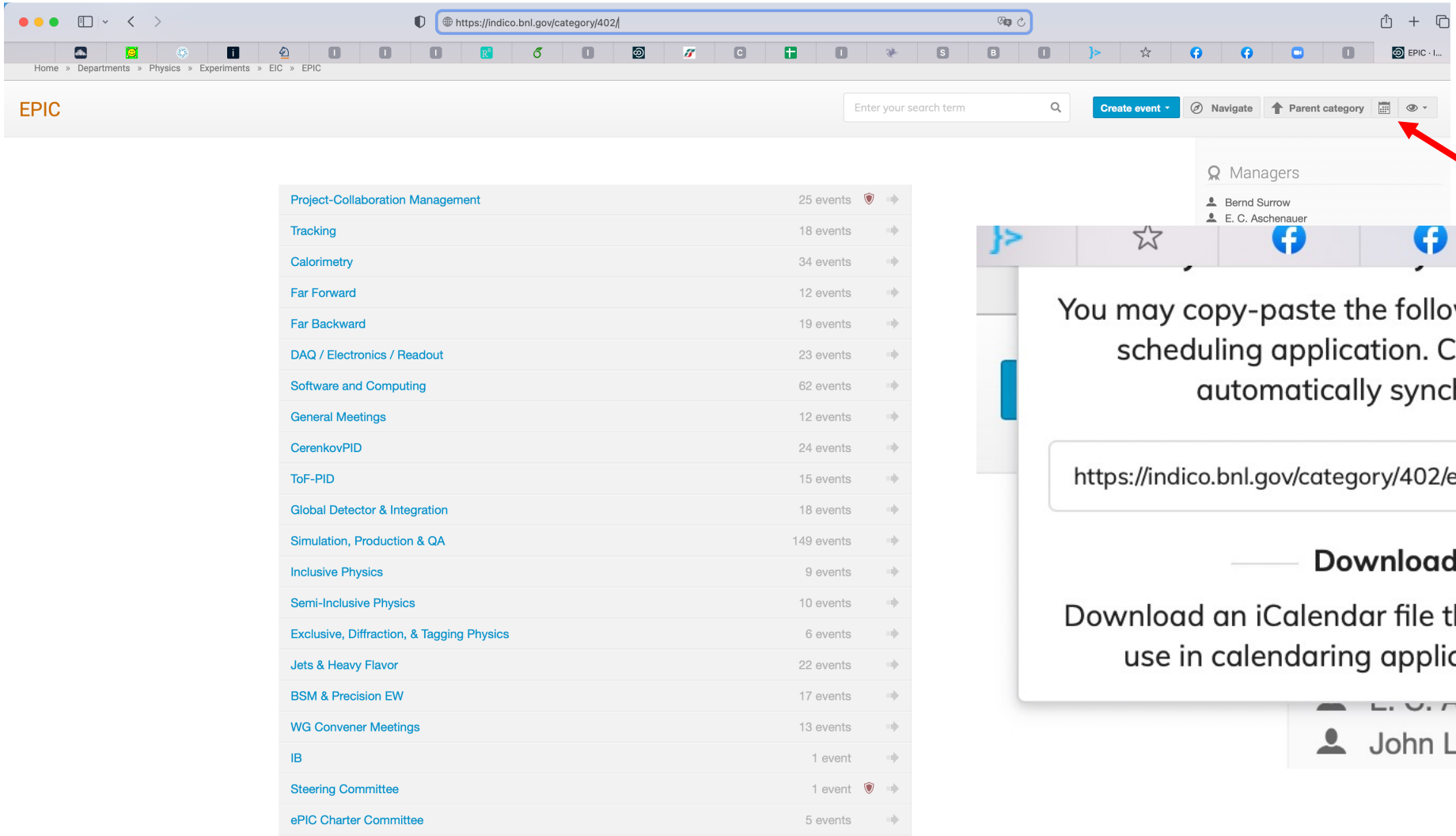
our community

NEW

+ eic_net-tracking

sub-system: think about others...

How to get involved (ePIC)



https://indico.bnl.gov/category/402/

How to get involved (ePIC)

https://lists.bnl.gov/mailman/listinfo

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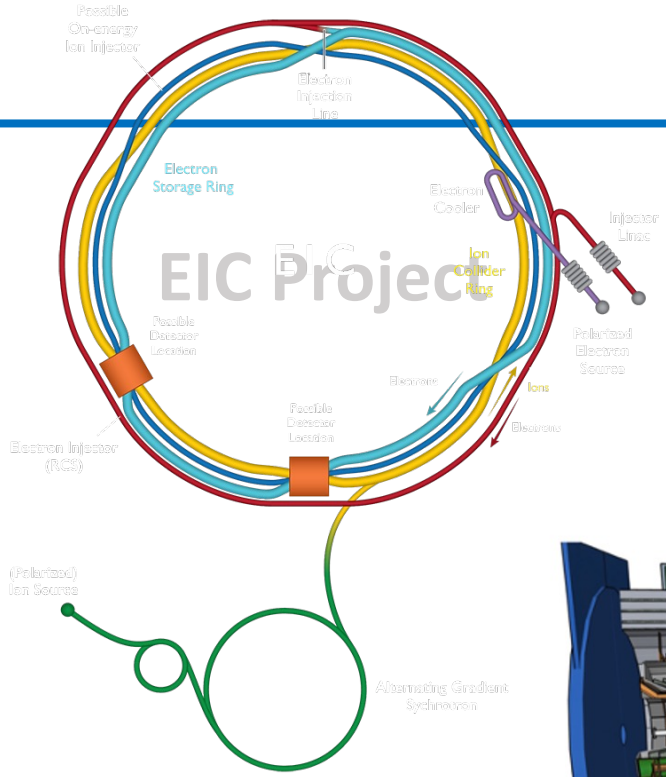

EIC Project

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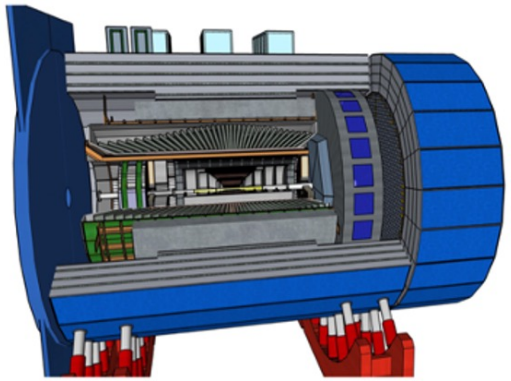
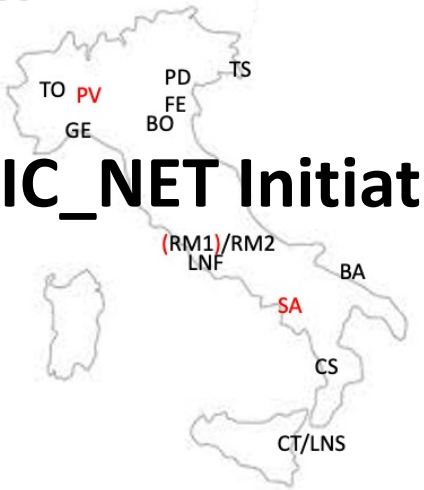
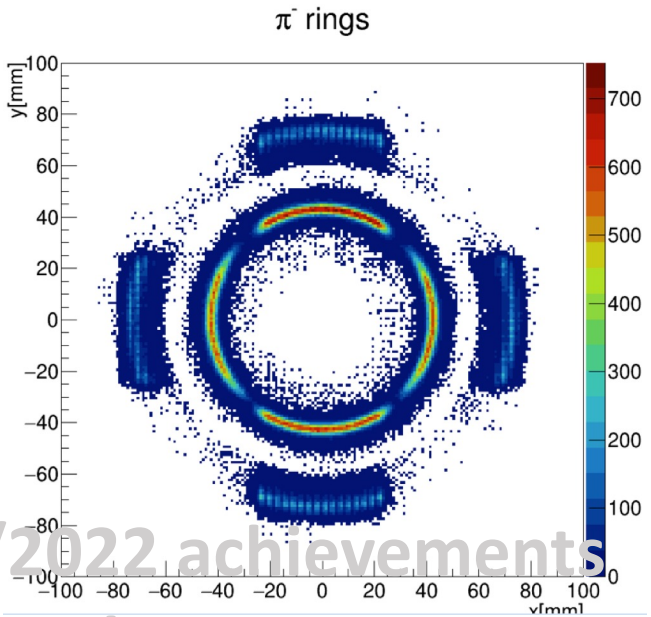


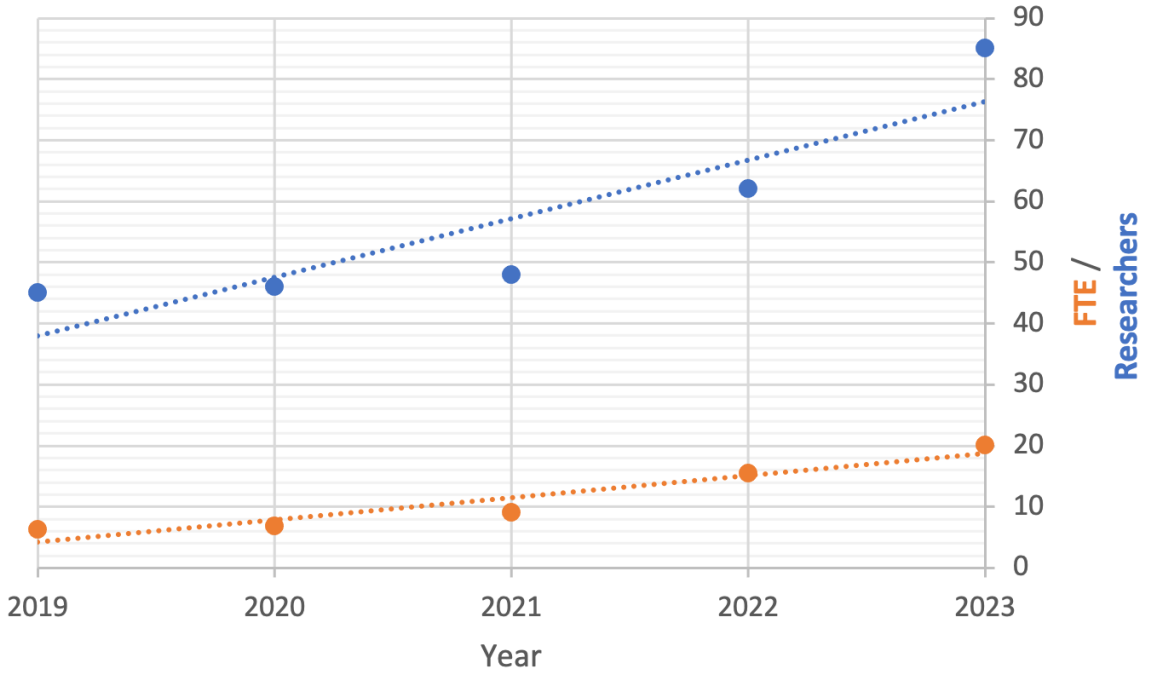


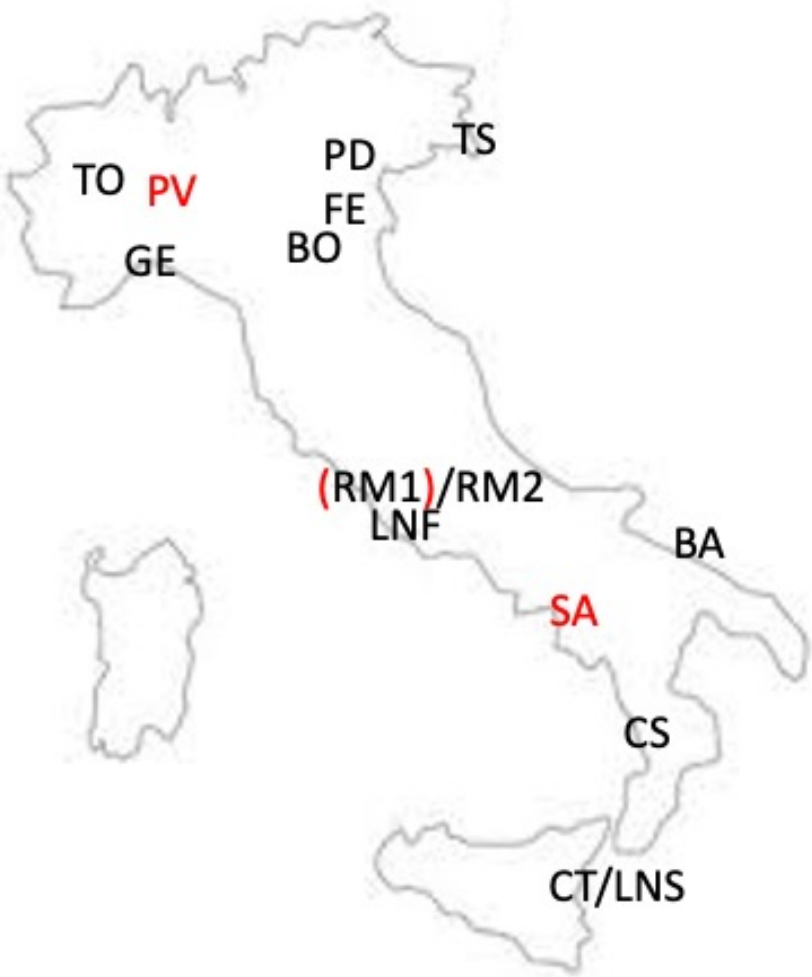
EIC_NET Initiative



2021/2022 achievements & 2024 plan

EIC_NET status: a growing community





Salerno and **Pavia** groups join EIC_NET and we hope it is just an "arrivederci" to **RM1**

A growing community with different background:
COMPASS, JLAB/CLAS12, ALICE, ATLAS, CMS, STAR, DARK SIDE, ...

EIC_NET: a growing community

year	researchers	FTE
2019	45	6.20
2020	46	6.80
2021	48	9.05
2022	62	15.50
2023	85	20.0

Group	Local Responsible	Researchers	FTE
BA	D. Elia	10	2.4
BO	R. Preghenella	11	2.75
CS.DTZ	S. Fazio	3	0.8
CT.DTZ	C. Tuvé	4	0.7
FE.DTZ	M. Contalbrigo	2	0.5
GE	M. Osipenko	7	1
LNF.DTZ	M. Mirazita	2	0.1
LNS	F. Noto	4	1.7
PD	R. Turrisi	6	1.35
PV.DTZ	M. Radici	1	0.1
RM2	A. D'Angelo	7	1.0
SA	D. De Gruttola	9	1.5
TO	M. Ruspa	7	1.1
TS	A. Bressan	11	4.8
Resp. Nazionale: P. Antonioli	**Totali:**	85	20.0

Note that as FTE we are largely exceeding agreed plan (EoI)
20 FTE was target for 2024

TABLE 1 – Labor and investment for R&D and construction in period 2021-2029.

	Years	Labor, scientists	Labor, technical personnel	In-kind investment R&D	In-kind investment constructions	Travelling	Manpower	Investment, TOTAL
		(FTE)	(FTE)	(USD)	(USD)	(USD)	(USD)	(USD)
R&D	2021	10 /45		minimal		minimal	0.4 M	0.4 M
R&D	2022-2023	10		1 M		0.3 M	1.6 M	2.9 M
R&D	2024	20						
construction	2025-2029	50 /100	10		7-8 M	0.7 M	12 M	19.7 - 20.7 M
	Investment 2021-2029, TOTAL			**1 M**	**7-8 M**	**1 M**	**14 M**	**23-24 M**

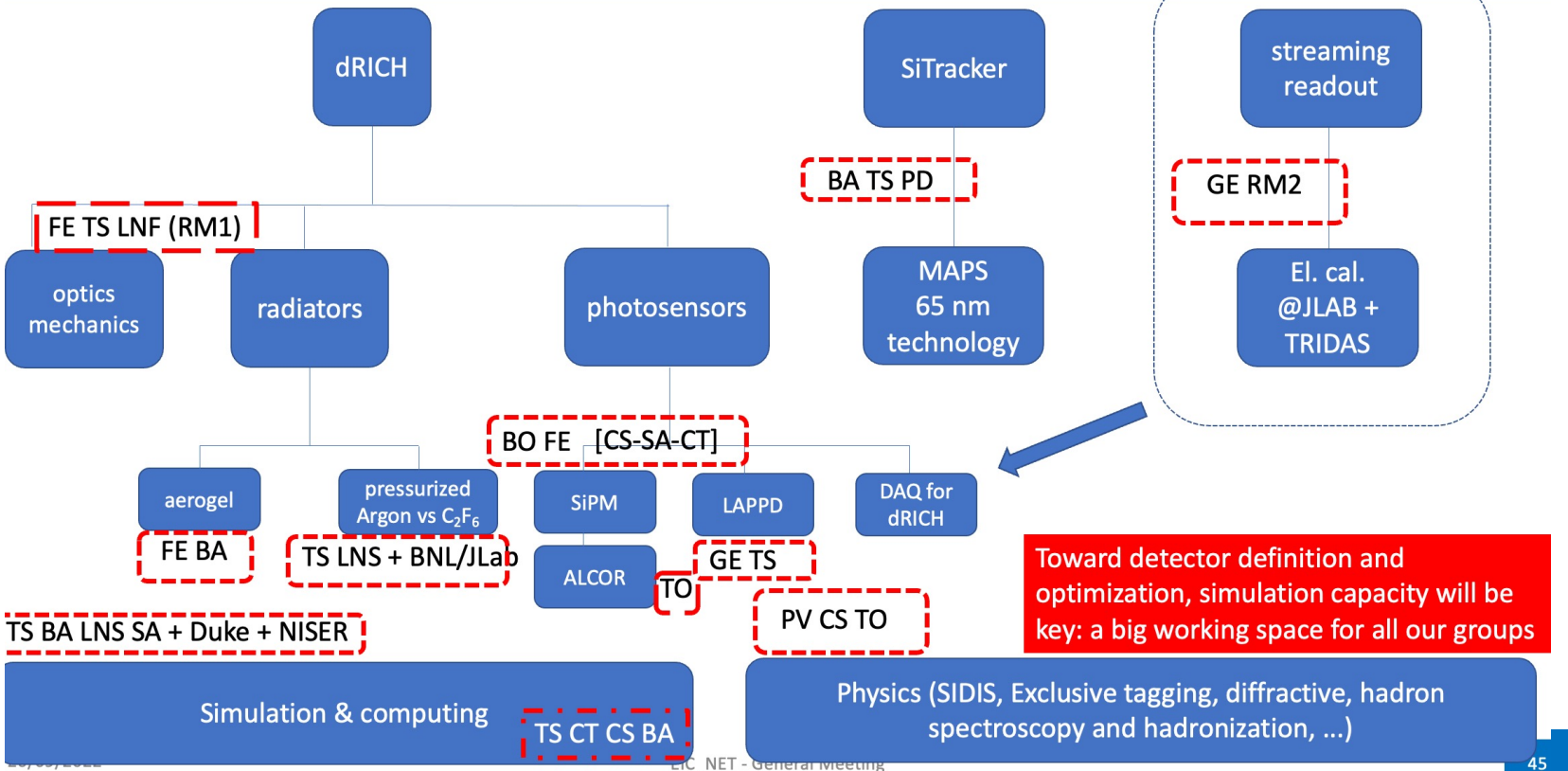
- TO, PD, RM2, SA → sigle (>= 1 FTE)
- PV, SA → new groups
- note FE (under DTZ) has a CTER (1 FTE) for EIC
- due to EIC-timeline, "EPIC" (since 2023) should be then considered "in fase di R&D e costruzione" up to 2029 [INFN-CSN3-QA-50 c. 12]

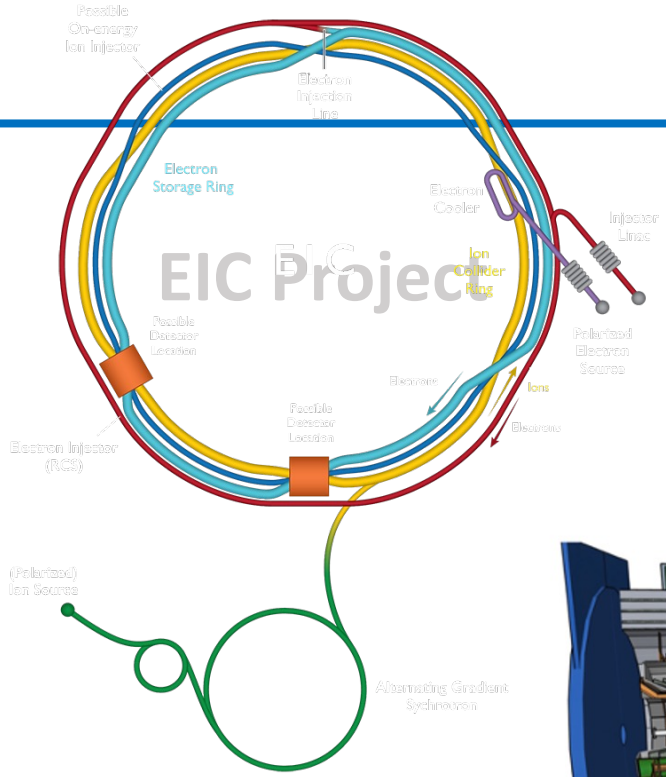
CNS3 budget session + plans

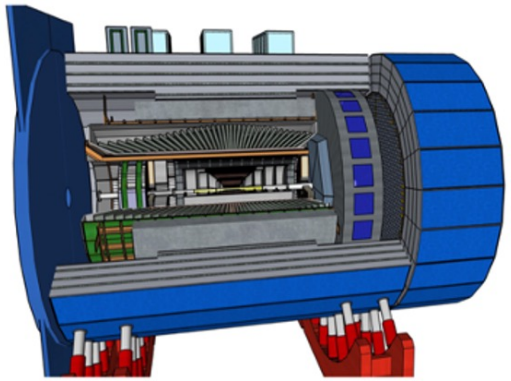
Positive evaluation by referee/CSN3:
Requests: 487 kEU (missioni 185 kEU)
Funded: 325 kEU (missioni 117.5 kEU)

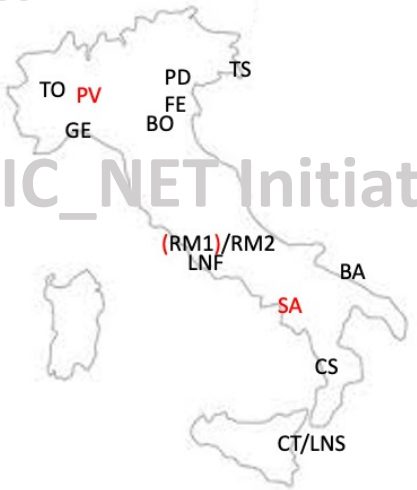
- Indication to grow FTE but general positive attitude!
- Understanding in 2024 we will move to sigla (EPIC)

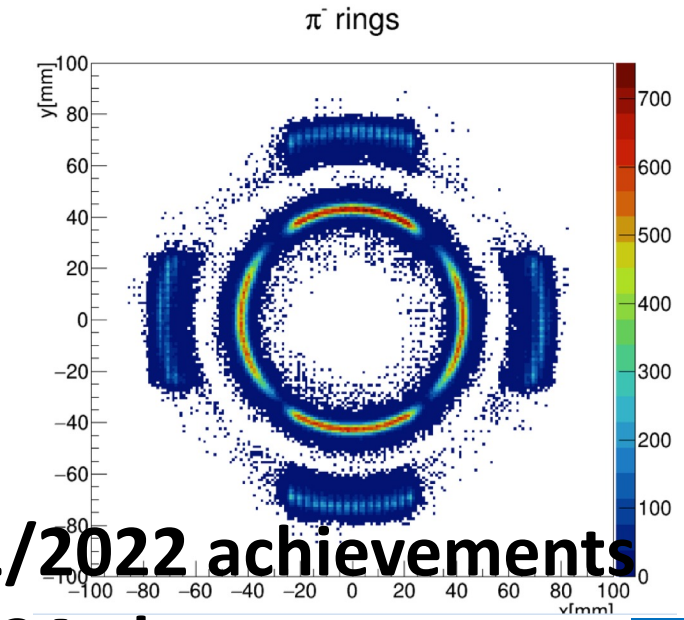
2023: from networking to experiment mode











Note: more information in slides provided meeting the referees (31/08/2022)
https://agenda.infn.it/event/32343/

2021/2022 achievements & 2024 plan

See next talks and report to CSN3

Dissemination work/ EIC_NET is improving its footprint

- SIF 2021 S. Dalla Torre, Stato del progetto EIC
- F. Ameli et al., Streaming readout for next generation electron scattering experiments , Eur. Phys. J. Plus 137 (2022) 8, 958
- INNF2022, S. Vallarino, The dual Ring Imaging Cherenkov detector for the Electron-Ion Collider
- INFN2022, C. Chatterjee, Particle Identification by the forward and backward RICHes of ATHENA proto-collaboration at EIC
- INFN2022, N. Rubini, SiPM response to radiation damage and annealing treatment for the EIC dual-radiator RICH
- INFN2022, S. Kumar, Performance simulation studies for the tracking detector at the Electron-Ion Collider
- "From RHIC to EIC", M. Contalbrigo, eRD102 - Forward RICH (dRICH)
- "From RHIC to EIC" P. Antonioli, eRD110 - Photosensors
- 15th Pisa Meeting on AD, S. Dalla Torre, ATHENA at EIC
- Otranto School, S. Fazio, Physics at the future Eletron-Ion Collider
- QCD@Work D. Elia, EIC as the next QCD collider
- ICHEP, L. Rignanese, A SiPM-based optical readout system for the EIC dual-radiator RICH (poster)
- NDIP R. Preghenella, A SiPM-based optical readout system for the EIC dual-radiator RICH
- HF-WINC, P. Antonioli, Quarkonia and heavy flavour at EIC
- RICH2022, S. Vallarino, "The dual Ring Imaging Cherenkov detector for the Electron-Ion Collider" (poster)
- RICH2022, R. Preghenella, A SiPM-based optical readout system for the EIC dual-radiator RICH
- RICH2022, C. Chatterjee, Simulation studies related to the particle identification by the forward and backward RICH detectors at Electron Ion Collider
- SIF2021, N. Rubini, SiPM response to radiation damage and annealing treatment for the EIC dual-radiator RICH

Set-up of a EIC_NET Conference Committee: P. Antonioli, M. Contalbrigo, D. Elia, M. Ruspa

Grow an EIC generation → EIC school

- A PhD starting next year it could be an experienced post-doc / young researcher at time of first collisions @ EIC → future leaders
- Building on JLab community + HERA diaspora, we have juniors and many LHC-native researchers to be trained on DIS, 3D structure of the proton, etc. We need to be "EIC-physics ready"

EIC School proposal

Slides by Annalisa Mastroserio

School dedicated to Electron Ion Collider
[physics and detectors]

- Who: ~20 students both from master thesis / PhD
- When: spring/summer 2023 -> 3.5 days
- Where : LNF/Bertinoro/Maratea/Vieste/.... Corigliano Calabro
  - October
  - Decide by September (based also on possible contribution from local Institutions)
- What : lessons from theory, detectors, hands on sessions (MC simulations)
  → Availability of Abhay Deshpande (international VIP guest)

Preliminary ideas on lectures

- Deep Inelastic Scattering history (from SLAC-MIT to HERA)
- Detectors: detectors and technologies chosen for DIS measurements at HERA (ZEUS, H1, HERMES)
- JLAB e COMPASS: overview of physics results
- EIC Physics Program: Nucleon tomography, Spin physics, Mass of the nucleon, Hadron spectroscopy
- Hands-on session on data analisys and simulation

S. Fazio (University of Calabria & INFN Cosenza) 33

- We understood from referees no funds available in CSN3 (we asked a contribution in missions)
- On-going discussions with CFNS (SBU) and CEA (France) for a "European EIC school" (STRONG2020++)

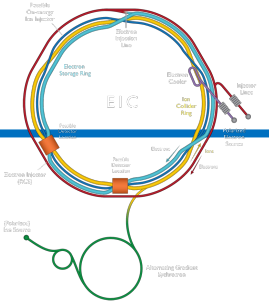
During next 8 years it will be critical to grow an EIC generation!

NuPecc

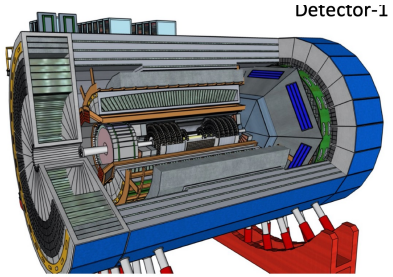
https://indico.bnl.gov/event/15342/contributions/64652/attachments/42455/71182/EICUG_NuPECC_2022_Sabatie.pdf

- Bottom-up consultation in progress for next long range plan
- EIC should have a space (within a EU agenda …)
- Contributions prepared by EICUG group
- Contributions prepared by national communities
- EIC_NET: P. Antonioli, M. Radici → draft → submit

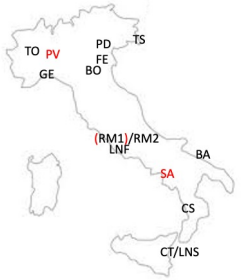
Summary and outlook



- **EIC project well on track** and very close to be "secured":
  CD-2/3A next big milestone (approval Jan 2024, pre-TDR October 2023)



- **EPIC Collaboration** for "Detector 1" **formed**, INFN contribution clearly delineated building on seminal work in 2019-2021. Now time to build alliances for dRICH.



- INFN participation taking shape, **moving from networking to experiment-mod**e, FTE exceedings target. 2023 should be "last year" as _NET. Tension on **resources** during next two years (both on missions and consumo).

- **Critical R&D for INFN** under way:
  - dRICH prototype tests: general performance, aerogel, pressurized Argon option
  - selection of technology for photosensors (SiPM as baseline, LAPPD as plan "B")
  - ASIC and FEE (and DAQ) R&D made accordingly
  - simulation effort toward pre-TDR

- take a seat on EIC physics and **grow an EIC generation**

EPIC logo context under way, stay tuned!

Electron Proton-Ion Collider Experiment

ePIC EXPERIMENT

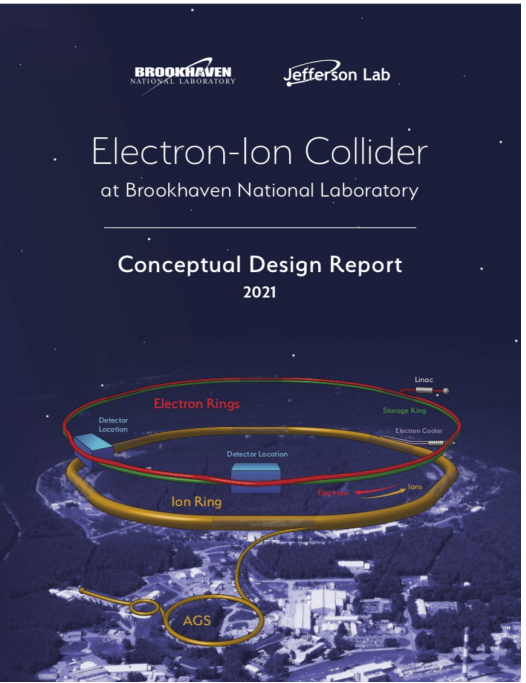
[and more...]

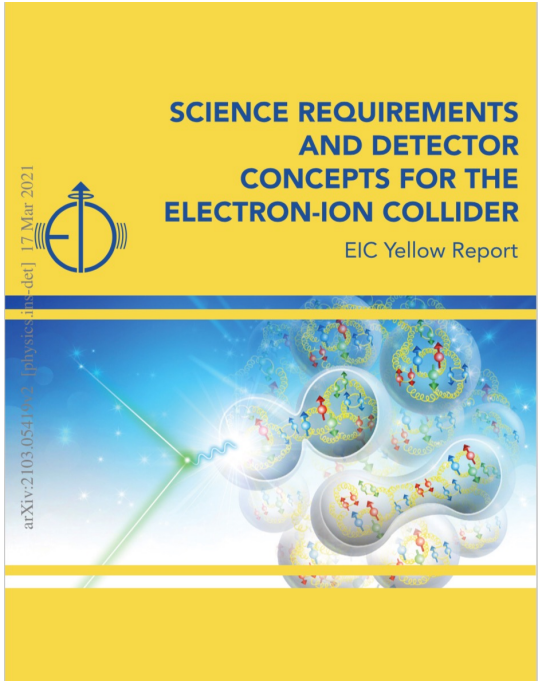

Backup

Status EIC project: 1 year ago recap

February 2021: EIC Conceptual Design Report: https://doi.org/10.2172/1765663
8 March 2021 Yellow Report released: https://arxiv.org/abs/2103.05419
March 2021: Call for detector proposals: https://www.bnl.gov/eic/CFC.php
March: First meetings of protocollaborations
28 June 2021: CD-1 passed "completion of the project Definition Phase and the conceptual design."
2-7 August 2021 EICUG meeting: https://indico.bnl.gov/event/11463/
10 August 2021 call EIC Detector R&D FY22: https://indico.bnl.gov/event/10974/contributions/53172/attachments/36485/59965/Detector_RD_Plan_Aug10.2021.pdf
20 September 2021: presentation at CSN3: https://agenda.infn.it/event/27668/contributions/140795/attachments/84822/112386/EIC_NET_CSN3_20092021.pdf
1st December 2021: experiment proposals sent to DoE (ATHENA, ECCE, CORE)
13-15 December 2021: first meeting of Detector Proposal Advisory Panel vis à vis proto-collaborations

2 INFN contributors
57/414 INFN in authors team





August 2021 Marco Radici elected vice-chair of EICUG SC
September 2021 Silvia Dalla Torre elected spokesperson of ATHENA

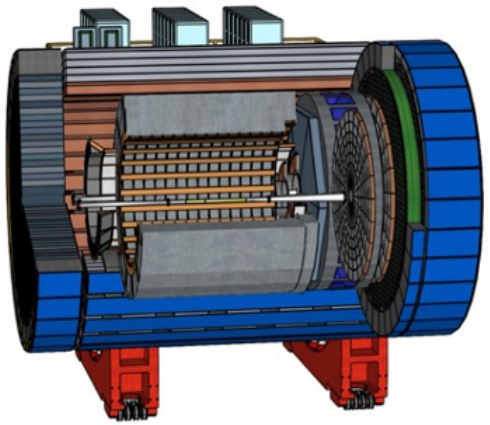
Status EIC project: the detector(s)

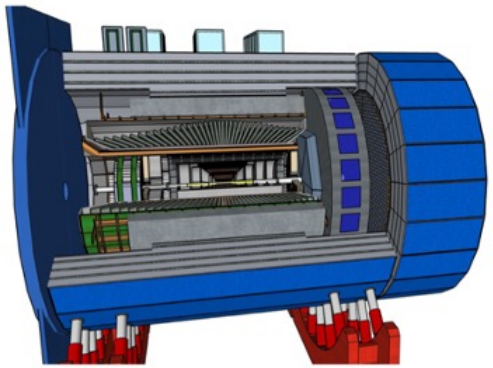
1st December 2021: experiment proposals sent to DoE (ATHENA, ECCE, CORE)
13-15 December 2021: first meeting of Detector Proposal Advisory Panel vis à vis proto-collaborations

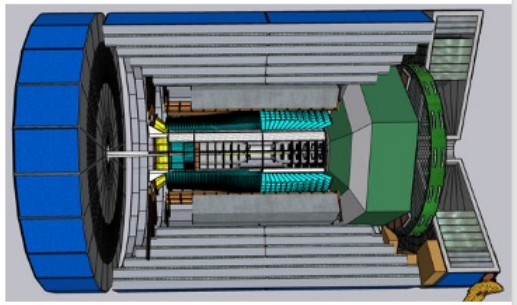
Detector proposals

- ATHENA is general purpose (full EIC science) for IP6 with new 3T solenoidal magnet (and large bore diameter)
- ECCE is general purpose detector for IP6 re-using 1.4 T Babar magnet (bore diameter 2.8)
- CORE is a more "compact" proposal, potentially for IP8 (3T solenoid as well)

Design of all proposal driven by YR requirements, obviously with differences...







20/12/2021

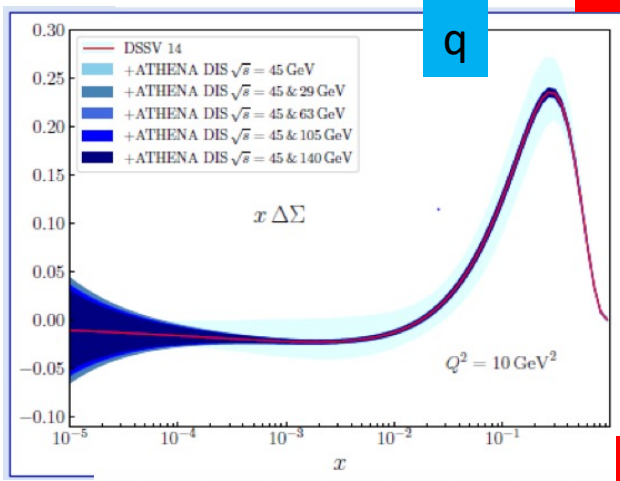
Giornata Nazionale EIC_NET 2021

6

Few physics highlights

spin of the proton

q



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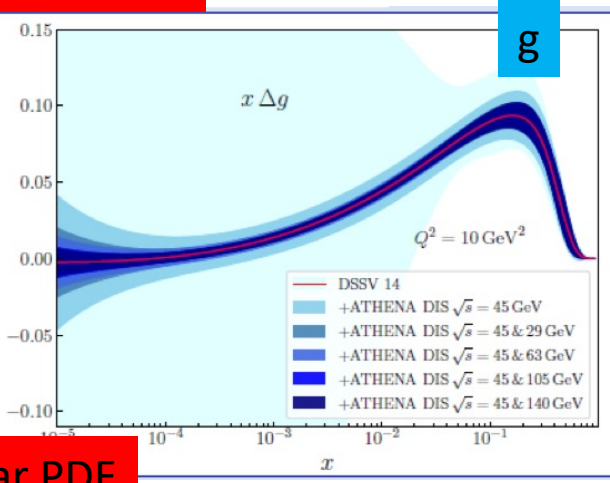
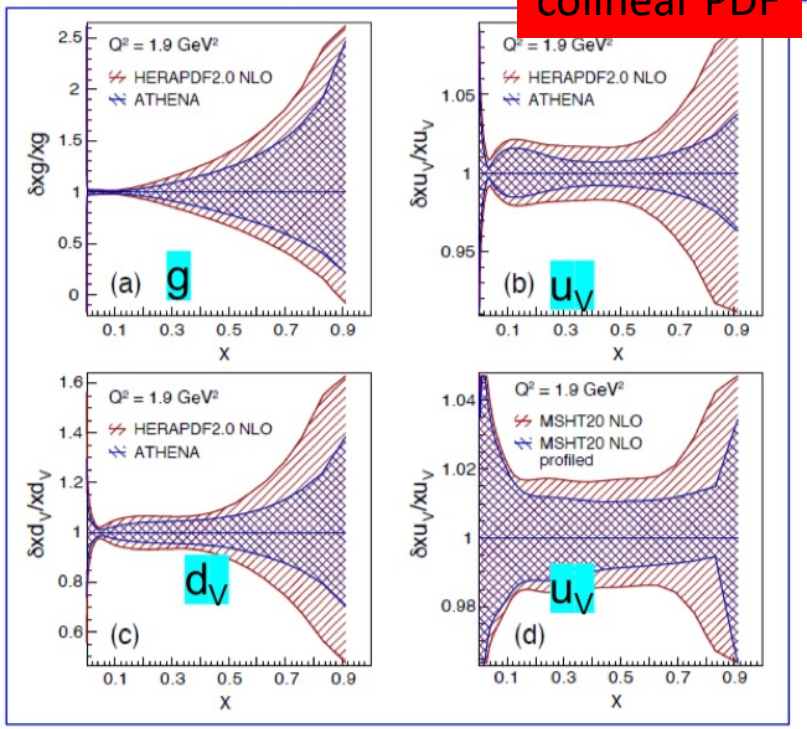


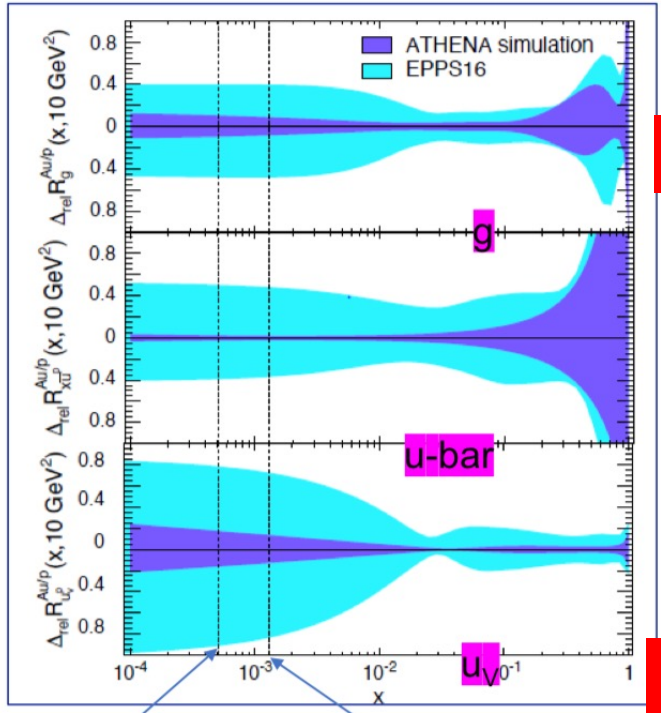
colinear PDF



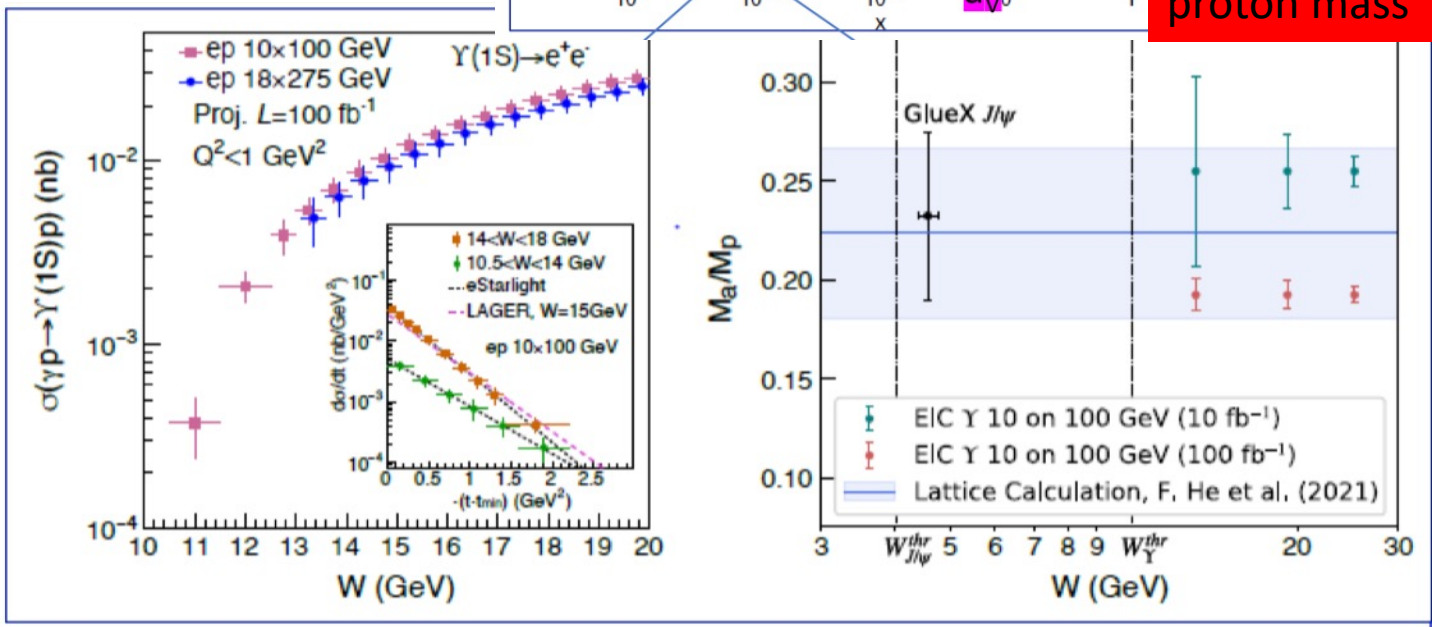
Au nucleus

xFitter framework

nPDF



proton mass



INFN contribution to ATHENA proposal

INFN supported ATHENA proto-collaboration efforts for a general purpose detector at IP6 able to cover all EIC science programme.
Thanks to previous work on YR + INFN EoI (Nov. 2020), INFN was very well placed in ATHENA organization:

- Coordination Committee: 1/8 (**S. Dalla Torre** → then spokesperson)
- Working Group Conveners: 5/37
- Charter Committee: 1/14 (M. Ruspa)
- Nomination and Election Committee: 1/6 (P. Antonioli)
- EIC Silicon Consortium Coordination Board: 1/6 (G. Contin)

5 italiani !

WGs and Conveners

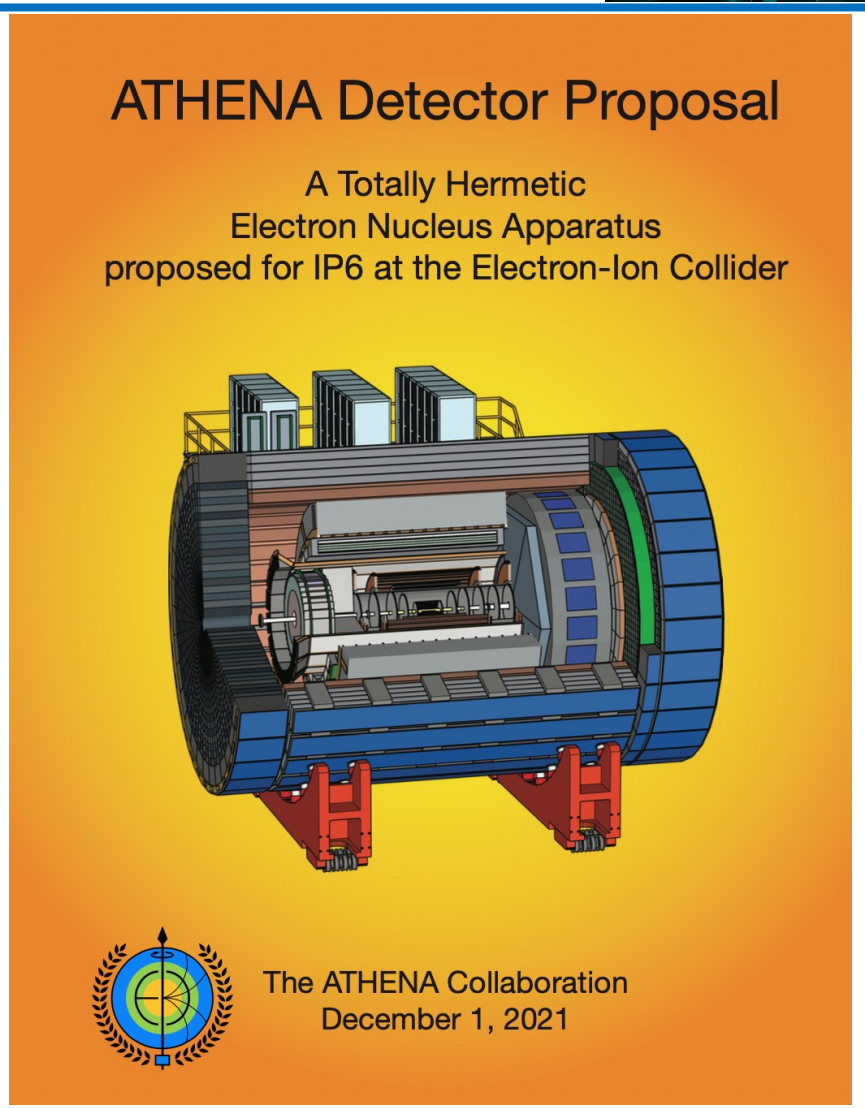
Software & Computing Working Group
CONVENERS: Sylvester Joosten, Dmitry Romanov, Whitney Armstrong, Andrea Bressan, Wouter Deconinck

PHYSICS

- **Inclusive Working Group**
  CONVENERS: Barak Schmookler, Qinghua Xu, Paul Newman
- **Semi-Inclusive Working Group**
  CONVENERS: Marco Radici, Anselm Vossen
- **Jets/HF/EW-BSM Working Group**
  CONVENERS: Ernst Sichtermann, Stephen Sekula, Brian Page, Miguel Arratia
- **Exclusive/Tagging Working Group**
  CONVENERS: Salvatore Fazio, Spencer Klein, Daria Sokhan

DETECTORS

- **Tracking Working Grouk**
  CONVENERS: Laura Gonella, Domenico Elia, Francesco Bossu, Matt Posik
- **PID Working Group**
  CONVENERS: Tom Hemmick, Roberto Preghenella, Franck Guerts
- **Calorimetry Working Group**
  CONVENERS: Oleg Tsai, Paul Reimer, Vladimir Berdnikov
- **Far Forward Working Group**
  CONVENERS: Alexander Jentsch, John Arrington
- **Far-Backward Working Group**
  CONVENERS: Krzyzstof Piotrzkowski, Jaroslaw Adam
- **Polarimetry Working Group**
  CONVENERS: Ciprian Gal, Oleg Eyser
- **DAQ Working Group**
  CONVENERS: Alexandre Camsonne, Jeffery Landgraf



ATHENA proposal published on JINST in 2022
Ref: JINST_063P_0522

Annual Report 2022

updated @ 23 July

Table of contents

1

EIC_NET 2021/2022 Annual Report available at:
https://cernbox.cern.ch/index.php/s/fhcWqVKbYCg6Am7

EIC_NET 2021/2022: consolidating the community

Main Indico entry: https://agenda.infn.it/category/1147/
Giornate Nazionali held in December 2021 and June 2022

https://agenda.infn.it/event/28762/

https://agenda.infn.it/event/30932/

- 50 attendants each meeting/ hybrid-mode with preference for "in presence"
- good occasion to involve new groups (SA, PV, TO...)

- ➢ bi-weekly meetings for dRICH/simulation and physics performance every Monday
- ➢ tracking activity within EIC Silicon Consortium flow
- ➢ national meetings ("online"): 31 Jan, 28 Mar, 3 Oct, 5 Dec

NEW

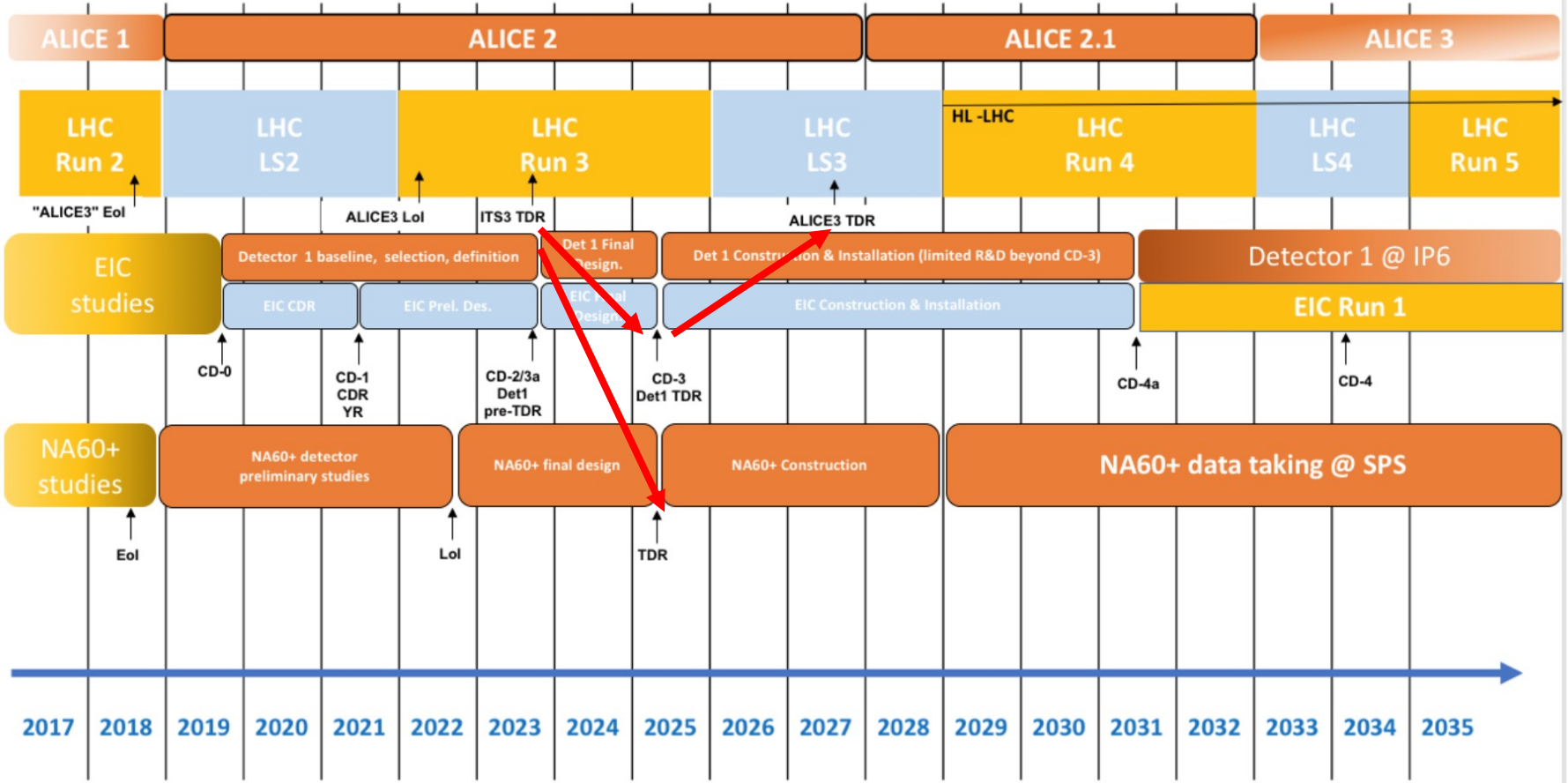
EPIC's life is also plenty of weekly meetings. WGs with active INFN presence:

- DAQ
- Computing and software
- dRICH reconstruction software
- Tracking
- global integration
- Cerenkov PID
- Semi-inclusive DIS
- Diffractive

Bi-weekly general meetings
+ (in presence): 2 Collaboration meeting/year

- ➢ 9-13 Jan 2023 (JLab)
- ➢ July 2023 (Europe, possibly Warsaw)

Synergies with ALICE and NA60_PLUS



Synergies on detector R&D activities between INFN groups working on ALICE-ITS3/ALICE3, EIC_NET and NA60+ initiatives and ALICE Italy

Document available here: https://cernbox.cern.ch/index.php/s/C7QUuny57ibvmxJ

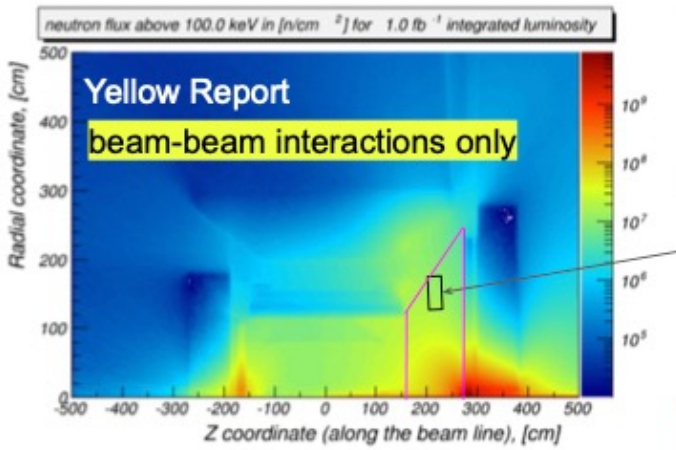
- document elaborated with ALICE and NA60+ colleagues following EIC_NET inititative
- meeting at CERN July 2021
- submitted to CNS3 and GE June 2022
- INFN very well positioned to maximize impact on all three experiments
- R&D requests/INFN funding already coordinated in 2023

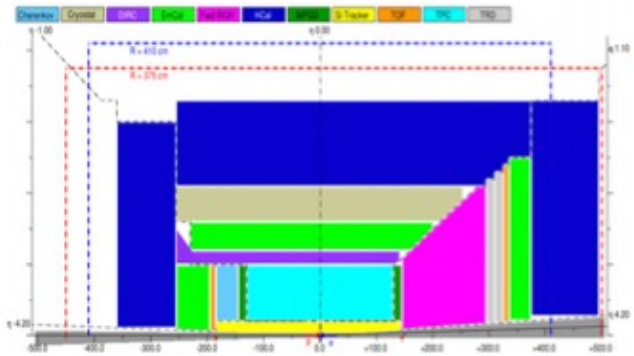
Common areas:

- MAPS@65 nm
- SiPM
- Aerogel
- (LAPPD)
- Digital SiPM

Radiation levels @ EIC

Neutron fluxes and SiPM radiation damage





Most of the key physics topics discussed in the EIC White Paper [2] are achievable with an integrated luminosity of 10 fb^{-1} corresponding to 30 weeks of operations. One notable exception is studying the spatial distributions of quarks and gluons in the proton with polarized beams. These measurements require an integrated luminosity of up to 100 fb^{-1} and would therefore benefit from an increased luminosity of $10^{34} cm^{-2} sec^{-1}$.

possible location of dRICH photosensors
neutron fluence for 1 fb^{-1} → 1-5 10^7 n/cm^2 (> 100 keV ~ 1 MeV n_{eq})

- radiation level is moderate
- magnetic field is high(ish)

R&D on SiPM as potential photodetector for dRICH, main goal
study SiPM usability for Cherenkov up to 10^{11} 1-MeV n_{eq}/cm^2

notice that 10^{11} n_{eq}/cm^2 would correspond to 2000-10000 fb^{-1} integrated $\mathcal{L}$
quite a long time of EIC running before we reach there, if ever
it would be between 6-30 years of continuous running at $\mathcal{L} = 10^{34}$ s^{-1} cm^{-2}

→ better do study in smaller steps of radiation load

10^9 1-MeV n_{eq}/cm^2	*most of the key physics topics*
10^{10} 1-MeV n_{eq}/cm^2	*should cover most demanding measurements*
10^{11} 1-MeV n_{eq}/cm^2	*possibly never reached*

4

EPIC: software model

Intense (and complex) review by the WG (confirmed then by an independent expert panel later in August)

Slide shown by on May 13, 2022

A Critical Path for EIC Software

Towards a unified software approach for the EIC

1. Assessment on the software solutions (pro & con list) together with the SimQA and DAQ working groups, guided by the EIC Software Statement of Principles.
2. Propose conclusion and recommendation to collaboration management and Project **by the Summer EICUG meeting**.
3. Software choice treated as any other technology choice? Optional independent review in the Summer.
4. Once decision is made, all new development should go in the official framework.
5. **Aim to have fully transitioned to the official software by October.**

Key decisions

Code repository:
- github + gitlab/EIC

Geometry description & detector interface:
- dd4HEP

Data model:
- PODIO for management
- EDM4hep

Reconstruction framework
- JANA2

JANA2
Multi-threaded HENP Event Reconstruction

Existing code under Gaudi/Juggler or Fun4all under adapatation re-use for JANA2 @ JLAB

The foreseen schedule (@ ATHENA submission time)

Start:				
Year:				
Q:				

	Year	2019				2020				2021				2022				2023				2024				2025				2026				2027				2028				2029				2030				2031				2032				2033			
	Q	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	nQ	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
	CD milestone				0						1								2						3																				4ae				4a					4e				4		

85	dRICH R&D	1/1/20	6/30/26	26
86	dRICH: Procurement	1/1/25	12/31/28	16
87	dRICH: Assembly (In-House)	1/1/28	12/31/28	4
88	dRICH: Assembly (in-situ)	10/1/28	9/30/29	4
89	dRICH: Test (in situ)	6/1/29	12/31/29	3
90	dRICH: Installation	12/1/29	6/30/30	3

111	Silicon: R&D - Silicon	1/3/22	9/30/25	15
112	Silicon: R&D - Modules, staves, disks, mechanics	1/3/22	9/30/24	11
113	Silicon: Construction - Silicon and Modules	4/1/25	6/1/28	13
114	Silicon: Construction - Staves and disks	3/26/25	4/6/28	14
115	Silicon: Construction - Mechanics	10/2/24	11/20/28	17
116	Silicon: Construction - Cooling	8/25/25	6/14/28	12
117	Silicon: Construction - Readout	6/25/25	6/21/28	13
118	Silicon: Construction - Power system	10/2/24	10/1/27	13
119	Silicon: Construction - Slow control	10/2/24	12/13/27	13
120	Silicon: Construction - Cabling	10/1/25	3/17/28	10
121	Silicon: Construction - Database	10/2/24	12/13/27	13
122	Silicon: Shipment of detector parts to BNL	7/6/26	12/22/28	10
123	Silicon: Detector assembly and testing at BNL	11/11/26	4/4/29	11
124	Silicon: Installation and testing vertex	9/1/29	9/30/29	1
125	Silicon: Installation and testing barrel and disks	9/1/29	6/30/30	4

Note added:

Now more or less a one year shift but schedule remains indicative of when we will need to start procurement (in 2026) and construction peak effort (since late 2028)

Milestone

Data	Descrizione
31 lug 2023	Sottomissione su rivista di risultati ottenuti in campagna di irraggiamento SiPM
30 nov 2023	Realizzazione di una ampia superficie di rivelatori SiPM per la lettura ottica del prototipo dRICH basata su readout ALCOR.
31 dic 2023	Misura della resa di produzione e ottimizzazione delle dimensioniÂ deiÂ sensori CMOS 65 nm stitched per Detector-1 tracker
31 dic 2023	Contributo a simulazioni Detector 1 (in particolare per Si-Vertex e dRICH) per pre-TDR Detector 1
31 dic 2023	Contributo a studi di physics performance per Detector-1 nei canali esclusivi attraverso EpIC generator
31 dic 2023	Organizzazione giornate nazionali EIC
31 dic 2023	Milestone aggiuntiva (17-09-2022 14:41:27)

Nota su richiesta referee (aiuto db va aggiornato dai referee....)

Milestone 3 modifcata: "Presentazione schema di ottimizzazione delle dimensioni dei sensori CMOS 65 nm stitched per EPIC tracker sulla base della resa di produzione da ER1 ITS3”

Milestone aggiuntiva: "Misura in campo magnetico delle performance di prototipo LAPPD" (31/12/2023)